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Factors Contributing to Agro-Logistics Performance Improvement from an Ethiopian Context

Busha Temesgen

Assistant Professor of Logistics and Supply Chain Management, Addis Ababa University, College of Business & Economics, School of Commerce, Ethiopia. Email: bushatm2003@gmail.com

Abstract

Agriculture is considered as the mainstay of the Ethiopian economy. The study aims to examine the factors that contribute to the agro-logistics performance improvement. Factors such as regulations and policies, coordination among stakeholders, custom procedures, information technology and communication network usage, transport and warehouse facilities and building human competence were considered. Descriptive and correlational designs were employed to address study objectives. Primary data collected using questionnaire with Likert scale was used. In total, 201 respondents were selected to whom questionnaires were distributed. A total of 151 usable responses were obtained and used for the analysis. Data collected were analysed using mean, median and frequencies along with correlation test to show relationships. The level of importance of aligning logistics related regulations and policies, coordination among stakeholders, transport and warehousing facilities, the use of ICT and communication networks, developing human competence and transforming customs system is very high. Almost all of them were found to have a moderate contribution to the performance of the Agro-logistics with the exception of some variables. The study suggests maintaining alignment of logistics related legal framework, creating a platform that brings together the actors in the sector and investing on the state-of-the-art technology pays a lot and need to be given due attention.

Keywords: Agro-Logistics, Performance Improvement, Ethiopia, Logistics

Introduction

Ethiopia is a country endowed with abundant agricultural resources such as good climate, ample arable land, plentiful labour, adequate rainfall and diverse ecological zones for growing different commodities. Agriculture is considered as the mainstay of the economy. The government identified agriculture and logistics as two of the five key priority intervention areas over the 2021 to 2030 period to increase productivity, ensure food security and achieve import substitution. Agricultural products fall into foods, fuels, fibres and raw materials comprising varieties of crops, vegetables, fruits, flowers and herbs, which are highly perishable. The agro-food sector plays a significant role in the economy, being one of the main contributors to the Gross Domestic Product of many countries, particularly in developing countries, where the share reaches as much as 50% (Wajszczuk, 2016, Tilahun, 2014; UNIDO, 2017). The future of a nation and then organisations depend on the prevailing human capital. Among other things, the food consumed by citizens is a significant determinant of people's health and academic performance (Popkin, Adair & Ng, 2012). According to the World Health Organisation (WHO, 2000), nutrition is a fundamental pillar of human life, health and development across the entire life span from the earliest stages of foetus development, at the time of birth, through infancy, childhood, adolescence and old age.

Agro-logistics is that part of the agricultural supply chain that plans, implements and controls the effective & efficient flows and storage of agro-products and related information from the point of origin to the point of consumption/destination (Kurbatova et al., 2020; Deineha et al., 2022). It plays a vital role in availing inputs to producers, supplies to processors and products to consumers. Particularly for perishable products, their transportation, storage, handling and packaging highly matter. Ethiopia is located closer to agro-product markets with excellent growth potential. Data from MoT and NBE

2020/21 revealed Ethiopia's significant destinations for agricultural export during 2019/20 were Asia (31.0%), Europe (41.0%) and Africa (17%).

Ethiopia can produce high quality varieties of agro-products; and possesses competitive advantages in crops such as oil seeds and cotton, and horticultural crops such as flowers, fruits and vegetables. The government has been providing a variety of incentives to those investing in the sector.

Although the country is capable of producing organic and varieties of high-quality agro-products, the earning the country gets from the sector is not in line with the potential the country possesses (Allaro, 2011; Allaro, Kassa & Hundie, 2011).

African and emerging countries' logistics performance lagged behind that of developed countries, resulting in lesser growth in the agriculture sector (Shikur, 2022). Despite significant increases in agricultural output between 1993 and 2018, Ethiopia's agriculture and food system is not well equipped to support access to healthy diets for its rapidly growing and urbanising population or to stimulate broad-based economic transformation. The price for certain commodities in urban areas is higher than that of the international market. The linkage between agricultural producers, commodity markets, processors and commercial value chains is not well-established. Different regulatory organs were established with functional approach where alignment among them seems minimal.

Wastage between the farm gate and the final consumer is often 40% in fresh products and up to 20% in cereal crops, contributing to unnecessarily high prices. The country experiences critical constraint such as a lack of infrastructure to support supply to processors and the presence of numerous intermediaries that contributes to wastage and inefficiency; and lost its advantages often due to poor linkages and limited knowledge regarding best practices.

This might be reflected in the poor logistical performance as the status of the country in terms of the Logistics Performance Index (LPI) was 141st out of 155 in 2012, 104th out of 160 in 2014 and 126th out of 160 countries in 2016 and 131st in 2018 (WB LPI 2012; 2014, 2016 and 2018). This is lower than Sub-Saharan African countries and even neighbouring countries (See Table 1).

Table 1: Ethiopia's Logistics Performance Index

Year	Rank	LPI Score
2007	104	2.33
2010	123	2.41
2012	141	2.24
2014	104	2.59
2016	126	2.38
2018	131*	2.4
2020	114**	2.51

* Aggregate LPI ranking. ** LP score based on domestic survey.

The perishability of agro-products results in increased logistical costs as they require a faster, better-equipped and well-coordinated logistics system. Thus, there is an obvious need to improve logistical service quality to ensure responsiveness and efficiency (Kebede & Hussen, 2015; Deineha et al., 2022). The country's logistical performance has been lower than even Sub-Saharan African countries on global index.

Whether improvements in alignment of logistics related regulations being implemented by regulatory bodies, the use of state-of-the-art information technologies, customs system, human resource development, coordination among stakeholders and transport and warehouse facilities improve agro-logistics performance or not is uncharted.

The study aims to find out the clarity and alignment of the legal and policy issues within which logisticians are operating; the coordination of stakeholders; the adequacy of the logistical infrastructure; efficiency of transportation and warehouse management operations; the competence of human resources and the efficiency of customs procedures by conducting an empirical investigation so as to understand whether such factors contribute to the logistical performance improvement from an Ethiopian context.

This study tried to address the following research questions:

- Whether alignment in logistics- related regulations and policies contribute to the improvement of the Agro-logistics performance from an Ethiopian context?
- Whether coordination, transport and warehousing operations contribute to the improvement of agro-logistics performance from an Ethiopian context?
- Whether the use of ICT, communication networks and human capacity building contribute to the

improvement of agro-logistics performance from an Ethiopian context?

Theoretical Background

Moving products from their point of origin toward their point of consumption has long been the focus of logistics systems (Deineha et al., 2022). Producing and processing agricultural products is not enough in some cases where timely delivery acquires critical role. Agro-logistics is a relatively new interdisciplinary field in the farm sector, focusing on the management of flows in supply chains of agricultural products and raw materials from production to delivery to the consumer, combining agrarian production, marketing, management and logistics. However, the practice was there since the ancient time. Agro-logistics is associated with the application of logistics methods and provisions in the field of agricultural production aimed at minimising labour costs, resource costs and transport costs by optimising transportation routes, and ultimately reducing the cost of farm products (Kurbatova et al., 2020; Deineha et al., 2022). It has become apparent that agro-logistics provides a competitive advantage for companies aimed at ensuring an uninterrupted supply of their products to an intermediate or final consumer, and also serves as a crucial factor in ensuring the food security of a nation (Kiladze, 2017; Kurbatova et al., 2020).

To measure and improve logistics performance (Hwang et al., 2017), it is essential to identify factors that affect logistics performance. Some researchers focused on critical factors that affect the supply chain in general rather than logistical performance such as environmental uncertainty, information management and communication (Li et al., 2006), relationships among partners and risks within the context of an offshore sourcing decision (Schoenherr et al., 2008; Ambrose et al., 2010; Gacuru & Kabare, 2015). However, the two are not the same.

In most countries, government actively develops appropriate domestic logistics systems and cross-border trade facilitation (Arvis et al., 2014; Cheong & Suthiwartnarueput, 2015). For instance, laws, regulations, policies and procedures related to logistics systems developed by the government (through its various agencies) can either facilitate or hinder cross-border trade. Logistics service providers must comply with multiple regulations relating to entry, registration, company set up, vehicles and facilities owned and operated, liabilities, etc., and interact with different government agencies mandated with monitoring and control. Cross-border trade can be facilitated if such laws, regulations and policies are aligned.

Alignment of logistics regulations, thus, emphasises regulating the logistics sector in a comprehensive way, having regulations and policies that create a competitive environment; enable monitoring of performance and presence of logistics hubs.

Developing and maintaining logistics infrastructure requires long-term sustained efforts of governments (Hwang et al., 2017; Arvis et al., 2016; Feng et al., 2012) - a major challenge for developing countries. Domestic and global logistics infrastructure for agricultural products with short shelf life requires efficient network design to deliver products and services to customers promptly. Strategic infrastructure development defines long-term plans to improve capable intermodal transportation networks, including integration between maritime, land and air transportation for overall economic growth and societal development (Hwang et al., 2017).

Countries with well-organised logistics systems have excellent transportation systems (Panova, 2011, Zuraimi et al., 2013) that facilitate information, products, services and cash flow through the value chain and attract potential investors.

Transport and facilities emphasised timely maintenance of transport and related facilities, rewarding those who invest in the sector, considering the environmental implications of the facilities, locating facilities at the right place and meeting national standards ensured through inspections.

Communication network configurations refer to the systematic implementation of the broad scope of practical information flows through inter-firm and industry-wide interfaces (Wong et al., 2009). Properly using information technology increases a firm's capabilities to improve service quality, decrease logistics costs and enhance productivity (Lai et al., 2007; Hwang, et al., 2017).

Hwang et al. (2017) claim information technology advances catalysed for the unprecedented growth of public-private logistics including intermodal transportation systems. Communication and information flow considers the provision of ICT for information exchange, integration to facilitate information flow,

communication that enables policy formulation, employing ICT to ensure the security of goods in transit.

Human competence deals with building the capacity of both practitioners and governing bodies through special training and demanding certification of logistics practitioners. Competences of staff and staff skills have been found to influence the efficiency of logistics performance in different industries (Gacuru & Kabare, 2015). Logistics has become more prominent and is recognised as a critical factor in competitive advantage for any organisation (Bowersox et al., 2010), requiring employees trained in the area.

Proper logistics infrastructure serves as instrumental to attracting potential investors to set up new business activities or expand existing ones (Zuraimi et al., 2013). To integrate geographically dispersed product sources seamlessly, producer firms depend on 3PL providers that free firms to focus on their core business and improve total cost performance in their supply chain (Hwang et al., 2017).

Infrastructure also focuses on formulating policies and rules that foster investing in logistics infrastructure to enable safe, energy efficient and environmentally friendly operations.

Gacuru and Kabare (2015) argue that coordination among stakeholders or business to business relationships positively affects logistics performance efficiency and enhances the firm's financial performance. Coordination among governmental and private stakeholders manifested by engaging in dialogue, harmonised interest among regulators, collaboration and building trust measures coordination.

Customs systems include promptly upgrading customs and border procedures that enhance the inspection and clearance of goods, and maintaining consistency of the applications of related laws and regulations.

The World Bank identifies six components to measure logistics performance, including:

- The efficiency of customs and border management clearance.
- The quality of trade and transport infrastructure.
- The ease of arranging competitively priced shipments.
- The competence and quality of logistics services.
- The ability to track and trace consignments.
- Timeliness of shipments reaching the destination (Ojala & Celebi, 2015).

Stakeholder Theory

Logistical service provision involves a multitude of actors, either internal or external that will influence and are influenced by organisational practices. Stakeholder theory introduced by Freeman in 1984 helps to understand how a company manages its business activities while considering the interests of its various stakeholders.

The theory has been used in studies relating to green logistics, green supply chain management, integration with suppliers and customers, collaboration with suppliers and various other management practices (Huge-Brodin, 2020).

Specifically, agricultural product export involves complying with different laws and regulations, complying with customs requirements, using various logistical infrastructural resources (roads, railways, ports, warehouses, vehicles, etc.), application of IT and communication networks, maintaining a sustainable environment, and so on.

Thus, those who enforce the laws, provide infrastructural resources, avail communication networks and allow the timely flow of information and money, provide logistical services and export products all either promote or hamper the improvement of logistical service quality.

Based on the preceding discussion, the factors considered were legal and policy issues within which logisticians are operating; the coordination of stakeholders; the adequacy of the logistical infrastructure; efficiency of transportation and warehouse management operations; the competence of human resource and the efficiency of customs procedures along with their potential contributions.

Performance indicators comprised an increase in a number of businesses going global, improved efficiency of traders & producers, enhanced resource utilisation, creation of employment opportunities, and enhanced living conditions and national competitiveness (Knemeyer et al., 2002; Erkan, 2014; World Bank, 2015).

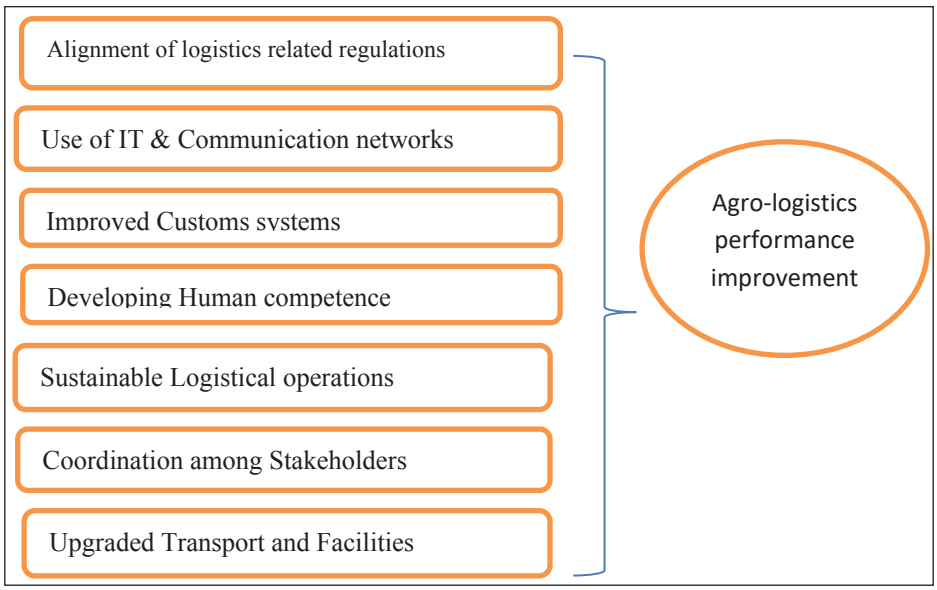

Fig. 1: Conceptual Framework (Own)

Materials and Methods

Research Design and Approach

To achieve the study objectives and address the research questions, descriptive and correlational designs were employed and tried to show whether the identified study factors contribute to the improvement of agro-logistics sector performance from an Ethiopian context. Thus, the study is non-experimental descriptive research, which examines what factors contribute to the performance improvement of the agro-logistics sector. The study used quantitative research approach as the data collected were quantitative.

Study Population and Sample Size

The study population comprises those who are practicing logistics activities and are an expert on the study subject, such as academicians, consultants, trainers, freight forwarders, customs clearing agents, customs employees, port operation employees, employees from shipping lines, employees from maritime affairs, employees from agro-farms and employees from institutions working in the areas of agro-products and so on. Thus, the study population was assumed to an infinite as an accurate record of data for each category is missing and a sample size of 201 respondents was taken with a ±7 precision level at a 95% confidence level (Israel, 2003). Proper sample size determination formula was employed to determine the sample size for primary data. Questionnaires were distributed to those included in the sample. The formula used was $n = N/(1+N(e)^2)$. Among returned questionnaires, 151 (75% response rate) usable questionnaires were used for analysis.

Data Source and Instrument

In this study, primary data obtained through a questionnaire was used. The questionnaire involves 34 items for the seven contributing factors and seven items for the performance improvement. The items for the contributing factors followed a 7-point Likert scale to capture data on the importance level of the seven factors, where 1 = not important… 7 = extremely important. The items for performance improvement followed a 5-point Likert scale where respondents were asked their level of agreement on whether improving logistics contributes to indicators of performance improvement employed.

Data Analysis

Descriptive statistics such as mean and standard deviation were employed to summarise and analyse data. Frequency distributions of individual variables, bar charts and pie charts were employed to present the results. SPSS v. 22 was used as a tool in the process of analysing the data. Correlation tests were made to show the relationship

among the factors. Correlation coefficients were interpreted as very high when in the range of 0.90 - 1.00, as high when in the range of 0.7 - .90, as moderate when between 0.5 and 0.7, low when from 0.3 - 0.5 and from 0.00 to .30 as negligible correlation following suggestion provided by Mukaka (2012). This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The data supporting findings of this study are available on request from the corresponding author. The data are not publicly available due to the information content that could compromise the privacy of research participants.

Reliability and Validity

The validity of the data collection instruments was ensured by conducting pilot tests with 20 respondents and working with practitioners to comment on them. The paper incorporated valuable feedback and comments obtained from the researcher's colleagues.

To check for the reliability of the data collected, items with Cronbach's Alpha coefficient of above 0.7 were used for the final analysis.

Table 2: Reliability Coefficient

Factor	Cronbach's Alpha	N of Items
Alignment of Log reg	0.744	4
Coord among SH	0.752	5
Commn & info flow	0.888	5
Log Infrastructure	0.858	3
Transport & Facilities	0.921	8
Human Competence	0.803	3
Customs Systems	0.842	5
Agrilog Perf Improve	0.932	7

Response Rate and Respondent Characteristics

Response Rate

Out of the 201 questionnaires distributed to respondents on a drop-and-collect approach, 151 useable questionnaires were returned being correctly filled and then used for analysis. The response rate is then 75%.

Table 3: Respondents by Gender

Gender		Frequency	Per cent
Valid	F	35	23.4
	M	116	76.6
	Total	151	100.0

The data in Table 3 shows that the majority (76.6%) of the respondents were male where as 23.4% of the respondents were female.

Table 4: Respondents by Job Category

Job Category		Frequency	Per cent
Valid	ACDN	10	6.6
	Consultant	4	2.6
	Employee	109	72.2
	Logistician	26	17.2
	Other	2	1.3
	Total	151	100.0

The data in Table 4 depicts that the respondents were academicians, consultants, employees, logisticians and those working in other areas of an organisation. The majority (72.2%) of the respondents were those working as an employee for their respective organisations in the areas of logistics. Those working as logisticians including freight forwarding service provision account for 17.2% of the respondents.

Table 5: Respondents by Work Experience

Experience in Years		Frequency	Per cent
Valid	Less than 5Yrs	52	34.4
	5 -10Yrs	77	50.8
	Above 10Yrs	22	14.8
	Total	151	100.0

The data in Table 5 reveals the majority (65%) of the respondents have a work experience of five years or more. This implies the respondents can comprehend the items in the questionnaire and provide insightful data.

Results

Table 6: Descriptive Statistics

Factor	Mean	Median	Std. Deviation
AlgtLogreg	6.02	6	1.129
CoorSH	5.92	6	1.125
ComInff	6.07	6	1.238
SLog Op	5.88	6	1.265
T&Fac	5.60	6	1.420
Humcomp	6.01	6	1.178
Customs	5.94	6	1.257

Key: AlgtLogreg = Alignment of Logistics related regulations; CoorSH = Coordination among Stakeholders; Cominff = Use of IT Communication network; SLog Op = Sustainable Logistical operations; T & Fac = Upgraded Transport and related Facilities; Humcomp = Developing Human competence; Customs = Improved Customs systems

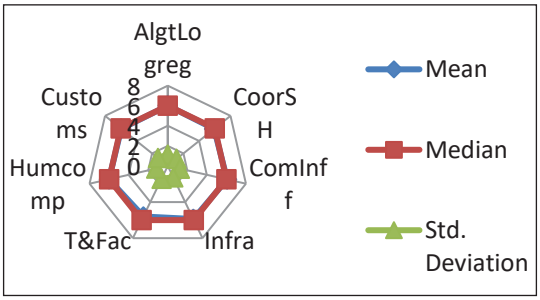

Fig. 2: Mean and Median Values

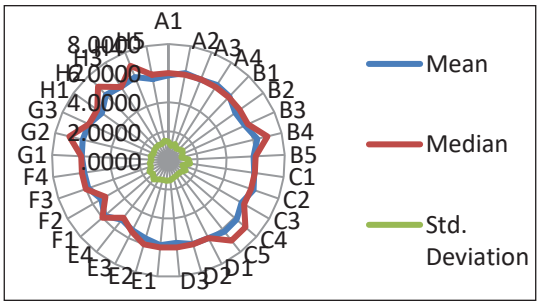

Fig. 3: Mean and Median for all Items

The importance of improvements in aligning logistics regulations, coordination among stakeholders, communication and information flows, infrastructure, transport and facilities, human competence and customs systems ranges between 5.60 and 6.07 on a 7-point scale. The median was 6 points on a 7-point scale, indicating a very high importance level of improvement in all the seven areas. The study found a high correlation between communication and information flows and infrastructure (r = 0.723), communication and information flows and transport and facilities (r = 0.714), infrastructure and transport and facilities (r = 0.701), and human competence and customs (r = 0.779). The study also found moderate correlation between alignment of logistics regulations and coordination among stakeholders (r = 0.603), alignment of logistics regulations and communication and information flows (r = 0.543), alignment of logistics regulations and communication and information flows (r = 0.579), coordination among stakeholders and transport and facilities (r = 0.505), coordination among stakeholders and human competence (r = 0.53), communication and information flows and human competence (r = 0.634), communication and information flows and customs (r = 0.599), communication and performance (r = 0.57), infrastructure and human competence (r = 0.607), infrastructure and customs (r = 0.522), infrastructure and agro-logistics performance (r = 0.515), transport and facilities and human competence (r = 0.649), transport and facilities and customs (r = 0.609), transport and facilities and agro=logistics performance (r = 0.543), and human competence and agro=logistics performance (r = 0.541). (See Correlation table annexed).

Discussion and Conclusion

The level of importance of improving logistics-related regulations and policies is very high (mean = 6,02 and median = 6) that matches with the claim by Yusufkhonov et al. (2021) and found to have low contribution to the performance improvement of the Agro-logistics sector from an Ethiopian context as the correlation coefficient is low (r = 0.429). The possible explanation for such lower contribution might be several regulations formulated and enacted by different actors. The level of importance of improving coordination among stakeholders (mean = 5.92 and median = 6), transport operations and warehousing facilities (mean = 5.60 and median = 6) is also very high and found to have a low and moderate contribution to the performance improvement of agro-logistics sector from an Ethiopian context as the correlation coefficients are r = 0.437 and r = 0.543, respectively. The possible explanation here might be multifaceted. The transport sector involves several players with different mandates, sometimes with conflicting roles. As the country is developing, operators with the latest state-of-the-art technologies and facilities are yet to come. Thus, improving coordination and partnership helps the development of logistics

infrastructure (Yusufkhonov et al., 2021). The level of importance of improving ICT and information flows (mean = 6.07 and median = 6), infrastructure (mean = 5.88 and median = 6), human competence (mean = 6.01 and median = 6) and customs system (mean = 5.94 and median = 6) and found to have moderate contribution to the performance of agro-logistics sector from an Ethiopian context except customs that has low contribution as the correlation coefficients are r = 0.570, r = 0.515, r = 0.541, and r = 0.467, respectively.

Aligning the regulations governing the agro-logistics sector allows to eliminate redundancies that result in time and cost saving. Thus, policy makers may use the study findings in crafting national policies that enhances performance at country level. Policy makers can also formulate a platform for the stakeholders to collaborate and enhance visibility in the agro-logistics value chain. The managerial implication of the study findings is that public-private partnerships may help to improve the investment in latest communication technologies, transport infrastructure and warehouse facilities.

Limitations

The first limitation was that the study didn't empirically test for casual relationships among the study variables. The second limitation was that the study was made based on cross-sectional data. The third limitation was that the study employed limited secondary data to substantiate the findings. Thus, future studies may further investigate the effect of these variables using more rigorous quantitative methods. Future studies may also consider longitudinal data such as secondary data particularly as a measure of agro-logistics performance.

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Annex 1: Correlation Table

Table 7: Correlation Result Among the Variables

			MeanReg	Meancood	MeanCoinf	MeanInf	MeanTFac	MeanHuCom	MeanCust	MeanPI
Spearman's rho	MeanReg	Correlation Coefficient	1.000	.603**	.543**	.292**	.347**	.377**	.302**	.429**
		Sig. (2-tailed)	.	.000	.000	.001	.000	.000	.001	.000
		N	151	151	151	151	151	151	151	151
	Meancood	Correlation Coefficient		1.000	.579**	.437**	.500**	.530**	.496**	.437**
		Sig. (2-tailed)		.	.000	.000	.000	.000	.000	.000
		N		151	151	151	151	151	151	151
	MeanCoinf	Correlation Coefficient			1.000	.728**	.714**	.639**	.599**	.570**
		Sig. (2-tailed)			.	.000	.000	.000	.000	.000
		N			151	151	151	151	151	151
	MeanInf	Correlation Coefficient				1.000	.701**	.607**	.522**	.515**
		Sig. (2-tailed)				.	.000	.000	.000	.000
		N				151	151	151	151	151
	MeanTFac	Correlation Coefficient					1.000	.649**	.609**	.543**
		Sig. (2-tailed)					.	.000	.000	.000
		N					151	151	151	151
	MeanHuCom	Correlation Coefficient						1.000	.779**	.541**
		Sig. (2-tailed)						.	.000	.000
		N						151	151	151
	MeanCust	Correlation Coefficient							1.000	.467**
		Sig. (2-tailed)							.	.000
		N							151	151
	MeanPI	Correlation Coefficient								1.000
		Sig. (2-tailed)								.
		N								151

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