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THE Role OF DIGITIZATION OF AIRCRAFT GROUND HANDLING ON SUPPLY CHAIN INTEGRATION OF ETHIOPIAN CARGO & LOGISTICS SERVICE

BY

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A THESIS SUMMITTED TO Addis Ababa UNIVERSITY, SCHOOL OF COMMERCE FOR IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER OF ARTS DEGREE IN LOGISTICS & SUPPLY CHAIN MANAGEMENT

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This is to Certify that the thesis prepared by DAWIT DESSALEGN TEGEGNE entitled: THE ROLE OF DIGITIZATION OF AIRCRAFT GROUND HANDLING ON SUPPLY CHAIN INTEGRATION OF ETHIOPIAN CARGO & LOGISTIC SERVICE submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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LETTER OF CERTIFICATION

This to certify that DAWIT DESSALEGN TEGEGNE has carried out his thesis work on the topic entitled “The role of digitization of aircraft ground handling on supply chain integration of Ethiopian Cargo & Logistic Service” under my guidance and supervision. Accordingly, I here assure that his work is appropriate and standard enough to be submitted for the award of Master of Arts in Logistics and Supply Chain Management.

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LIST OF ABBREVIATION

SCM	Supply chain management
SCP	Supply chain Performance
SCI	Supply chain Integration
ECLS	Ethiopian Cargo & Logistics Service
AGH	Aircraft Ground Handling
ICT	Information and communication Technology
ERP	Enterprise Resource Planning
GSE	Ground Service Equipment
IATA	International Air Transport Associations
KPI	Key Performance Indicators
BIA	Bole International Airport

ABSTRACT

Supply chain Integration has emerged as a major field of interest over the years that involve the strategic alignment of functions and processes within an organization as well as outside the organization. The concept of digitization comes across to be a perfect enabler for the required supply chain performance which is highly dependent on the integration level that exist within business partners in terms of cash, resource and information. Digitization, as far more than automation, reflects on end to end functional and process alignment with the support of the current ICT capability like internet of things , mobile processing and big data analysis . This study focus on examining the role of digitization of aircraft ground handling on supply chain integration of Ethiopian Cargo Logistics Service. Aircraft ground handling value chain involves different airport players and complex process with time constraint which needs information sharing and data driven dynamic decision making platform. The supply chain integration expressed in three sub grouped elements customer integration(integral, supplier and customer integration) , firm to firm collaboration and planning & control(information & measurement integration).The study have three objectives as follow ; assessing the digitization practice, identifying the digitization challenge of Ethiopian Cargo & Logistics Service and examining digitization role on the supply chain integration of Ethiopian Cargo & Logistics Service's aircraft ground handling . The research uses an explanatory design to understand the problem lying underneath the digitization implementation limitation within the company. Due to the nature of the study needs a group of experts involving in the aircraft ground handling directly involved or affected in the digitization process were selected for data collection. Questionnaires' were developed from similar literature to measure the above stated objectives and they have under gone with validly test from expert and reliability test using Cornbrash's alpha value . The result has discussed a highly positive role of digitization in the company's supply chain integration especially the customer integration sub group element while no significant influence on the firm to firm collaboration and measurement integration . It's also indicated that external factors especially technological factors have more influence on the digitization role of aircraft ground handling. Digitization in the company's aircraft ground handling must focus on the end to end output of each major process in the value chain ensuring information sharing and flow for data driven decisions.

Keyword: *Digitization, Supply chain integration, Aircraft ground handling value chain, information sharing*

CHAPTER ONE: INTRODUCTION

This chapter will present the study of research background, problem statement and research question, scope, limitation of the research and research paper organization and definition of important terms.

1.1 Background of the study

In current and expanded air cargo supply chain, there are multiple crucial players involved like carriers, forwarders, ground handlers, customs, custom agents, Cargo handlers and airports to deliver the required transportation service of cargo from point to point or from shippers to consignee without any irregularity or operational discrepancy. The global trade need the utmost coordination and collaboration between and within stakeholders involved in air cargo supply chain at process, procedure, documentation and technology level in order to maintain the two major KPIs of the air cargo, FAB (flown as booked) and DAP (delivered as promised). Although there are a lot of challenges at each stakeholder in the process which may require a technological solution, digitization in the supply chain is still struggling from lack of integration. (Patnayakun, 2002)

Digitization is more than an automation of a particular process or activity rather a broad concept which can result in a comprehensive information system integration and collaboration of internal core process. Timely and accurate information flow across the value chain ensures robust responsiveness, efficient planning of resources and contribute to effective decision making. (Genzorova, 2019) Air cargo supply chain, which is a booming industry across the world, can use of the current information processing power to boost its service to the next level. As one of the critical stakeholder involved in the supply chain, ground handling companies use such technological support as they are the major party with high need of coordination to provide their service at right time with resource constraint and can affect the entire supply chain performance as a whole in great deal of amount. (Vagheeswer, 2013)

Ground handler are the one taking care of most of the operational activities in the transportation part of the logistics activity starting from accepting the cargo to air craft loading/unloading and delivering the shipment to the consignee. The value contribution of ground handling companies within the overall value chain can be summarized as preparing the aircraft from its ground-time until

the next flight departure which includes major activities like aircraft marshaling, aircraft servicing, maintenance, flight data preparation, loading/unloading and GSE/staff allocating.

(Kolukısa, 2012) . Ground handling activities are conducted both at land side (before security check) and air side (after the security check) of the airports and/or cargo terminals. (El Asri, 2018)

But this paper is focused on the activities done at the airside which mainly involves aircraft ground handling. (Kovynyov & Mikut, 2018) discuss the value chain of aircraft ground handling will be benefited from the digitization concept as in improved customer service, streamlined operation, effective decision making and an opportunity to new business models.

In recent years, and beyond the overall effects of digital transformation on the way of doing business around the world, a further wave of digitalization has been detected in marketing and retailing that entails specific challenges in the interface with end consumers (Marta, Ana, & Vanessa, 2018)

The role of digitization on the value chain of ground handler's airside activities from both the core and supportive process perspective is critical, however identification of challenges in the overall information system integration that can create the expected value which ensures carriers or airlines to sustain their competitiveness across the supply chain must be given a priority on this research areas. (AlonsoTabares & -Camino, 2017) .

Supply chain management deals with the control of material and information flows, the structural and infrastructural processes relating to the transformation of the materials into value added products, and the delivery of the finished products through appropriate channels to customers and Markets so as to maximize customer value and satisfaction SCI as a concept is concerned with the synergy that exists between the internal functions of a firm and its external activities across its supply chain that leads to organizational performance. (Narasimhan, 2001)

In light of the above we take a look at Ethiopian Cargo & Logistics Service (ECLS), a major business unit in Ethiopian Airlines Group to conduct the case study on the subject matter. ECLS is currently involved in air freight transportation industry across the world with Addis Ababa as a core hub for its operational purpose. It's also a ground handling agent for its own and other customer airlines freight aircrafts here in Addis Ababa which digitization is partially exercised.

1.2 Statement of the Problem

Airside ground handling operation starts before aircraft arrival and ends after aircraft departure. Between these two critical events there are multiple actors involved and multiple activities conducted with utmost internal coordinated process. During aircraft arrival activities like marshaling, aircraft taxing & parking, Cargo unloading, coning and cocking, aircraft servicing, fueling, & ground service equipment (GSE) & staff assignment while during aircraft departure maintenance dispatching, cargo loading, load planning & push backing are the potential core activities. In this different mix of activities accurate and timely information flow is critical to the success of the value creation process. The automation of aircraft operations inside the airport parking area will provide opportunities for reducing fuel consumption, reducing cockpit crew workload, improving the predictability of parking and ground handling delays, improving the protection of people, materials and equipment. (AlonsoTabares & -Camino, 2017)

It has been implicated that airport ground operation has its own challenges to be more efficient and competitive enough with the above performance parameters due to internal as well as external integration problems.

Integration is the degree in which a central company has integrated the flow of information, physical material, and financial data with trading partners in the same value chain. (Reza , 2019)

Within the current digital age, digitization can offer the option to process and analyze millions of data to structured and desirable information in just minimum of second if we can manage to implement the proper approach to digitization on the existing business model. (Ram , 2001)It's believed that ICT can play a major role by supporting Firms optimizing or integrating their value chains through information technology to improve their competitiveness and Accommodation of information Technology creates a new value chain.

In ECLS, most of the activities are done electronically using different processing or executing systems like CARGOSPOT, CHAMP WEIGHT & BALANCE, MC FLIGHT CONTROL and MASAYA for cargo handling, aircraft movement, and aircraft status respectively. Although individual systems enable each section to use current technologies to achieve more information processing power, there is still a limitation in the level of system wide integration for better transparency, efficient planning and collaboration according to the ECLS's operational performance report and carrier's rating of the service given. As per the IATA monthly ground handling publications ECLS is still far behind in utilizing digital business model at its aircraft handling

service to enable streamlined operation in regard with cost, quality, time and safety parameters regardless of the overall parent company which is EAG paperless initiative. As a part of airport logistics, ground handling agents needs a robust logistics information system that can avoid uncertainty and loss of control, and enhance autonomous decision making on their core process like resources planning, aircraft servicing and maintenance, GSE movement control and cargo handling to deliver expected service performance like OTP, data quality, service transparency, no aircraft damage with the minimum resource allocation to multiple aircraft operations.

Among the critical characteristics of digitization in logistics cooperation, collaboration and connectivity are the major ones which need to be included in the design of the digitization process with minimal digital disruption to the business model. ECLS can use of the best from individual process automation needed in the coordination process of aircraft ground handling however real time information exchange at physical and functional level to act as a coordinated whole logistics flow has a significant impact on the success of coordination effort and overall service delivery performance. Thus, such limitation can cause ECLS's end to end logistics planning process and decision making capability at the aircraft handling operation. Among the issue at the airside operation due to lack of the above characteristics in the company's digital transformation framework ; almost eighty percent (80%) of the flights need extra time during handling, customer airline's communication is limited to emails with lack of self-service options and early planning, GSE movement around aircraft safe zone are unregulated and uncontrolled, communication flow is still with analog radio and repetitive phone calls lacking real-time information flow across the stakeholders in the airside ground operation. This can be observed in flight handling irregularities such as excessive delays, aircraft & equipment damage occurrences and quality issues like rework & resource waste (Kovynyov & Mikut, 2018) which is indicated on its last year facial operational report with seven percent (7%) of gross revenue considered wasted cost that should have been prevented.

Even with the above facts, there is a limitation of researches discovering the actual link or outcome relationship between digitization and airport ground operation as with a context of operational service industry. Thus the paper will complement additional knowledge in examining the role of digitization on airport ground operation through internal and external integration across the value chain.

1.3 Research Objective

The General objective of the research is to examine the role of digitization practices on organizational supply chain integration of ECLS's aircraft ground handling.

The specific objective of the study is as follows

- To assess the digitization practice of Ethiopian Cargo & Logistics Service's Aircraft Ground handling
- To identify the challenges of digitization in Ethiopian Cargo & Logistics Service's aircraft ground handling
- To examine the role of digitization on the supply chain integration of ECLS's aircraft ground handling

1.4 Research Question

For the fulfillment of the research purpose and with regards to the above mentioned research perspectives, the study is based on three major research questions

1. How digitization of the Ethiopian Cargo & Logistics Service's aircraft ground handling is being practiced?
2. What are the major factors for digitization challenges in Ethiopian Cargo & Logistics Service's aircraft ground handling?
3. What is the major role of digitization on Ethiopian Cargo & Logistics Service's AGH supply chain integration?

1.5 Significant of the study

In this digital age, companies are not only willing to adopt digital technologies to execute their functions but also forced to do so in the interest of their performance enhancement and customer satisfaction. Especially value creation practice across every supply chain can be facilitated and supported with the current information processing power to enable companies to deliver the most efficient and transparent service delivery with new degree of resilience and responsiveness.

ECLS as a freight and logistics operator need a continuous digitization process to sustain its position in the industry market place and improve its customer experience with ultimate digital solutions in every core and supportive process.

Aircraft ground handling as one major function of ECLS adopts process automation like most of worldwide ground handling agents to be more efficient and effective in its internal process which will result in meeting customer requirements and contribute in the value addition process of air cargo supply chain in general however there is a need to evaluate the effectiveness and efficiency of the digitization process to check with its vital characteristics implications in delivering what is needed across the entire value chain of aircraft ground handling process. This study can help ECLS's aircraft ground handling service to understand the challenges in its digitization process that hinders to achieve the required integration level in terms of finance, resource and information across the value chain.

This day's customers both end users and partners are seeking high level of service delivery with pure transparent platform with time, quality and constraint due to globalization and worldwide supply chain integration. This study can add an extension to the ongoing knowledge on the supply chain integration effect on firm's success across the value chain industry in terms of responsiveness to customer demand, flexibility to new needs and deals along with cost efficient provision of services to the research community.

Last but no least the study can contribute to add a another in-depth look to the developing countries aviation industry with respect to supply chain management concept in the reflection of the industry 4.0 which is digitization of everything for further understanding of existing problem and open new way to approach them .

1.6 Scope of the study

This research is mainly concerning on the evaluation or assessment of digitization implications of airside ground handling process which is directly related with freighter aircraft arrival and departure with all stakeholders involved. The time zone being studied includes pre aircraft arrival, during aircraft arrival and departure and post aircraft departure. In this paper, only the aircraft ramp handling activities will be considered: those that are in direct interface with the aircraft and are done at the airport ramp. Excluded are those activities like cargo acceptance and warehousing which is done physically elsewhere or seasonal handling activities like aircraft de-icing. The scope of this paper also covers only all civil freighter aircraft of ECLS which are ten Boeing B777F and two B737F aircrafts based on their higher capacity support to the airline cargo business compared to the

passenger belly capacity and study the operation at Addis Ababa international airport (ADD). The research encloses the process like cargo handling (loading/unloading), aircraft preparations & servicing, Planning and scheduling (GSE & staff assignment), GSE airside movement and management & performance process. Major Key concerns of the paper include challenges in the information flow integration among each operational process automation in execution as well as communication system components and evaluation of the current business model with complete logistic information integration based on digitization major characteristics as mentioned above. The focus area of digital technologies involves system utilized for only airside aircraft movement management, airside resource management, management reporting and operation control centers. Last but not least, this paper will consider the major digitization process millstones of ECLS that happened after 2015.

1.7 Overview of the Company

Ethiopian Cargo & Logistics Service is one of the major strategic business units of Ethiopian Airlines Group based in Addis Ababa Bole international airport (BIA) & Liege Belgium as an operational hub with the major product of freight transportation across the world. The business unit has ten boing 77F and two 37F freighter aircrafts in addition to the belly capacity of all the passenger aircraft from the passenger unit to meet the cross Atlantic trade lane market demand especially far & south east to Africa along with middles eat and Europe which need air cargo service with in the supply chain .Ground operation is the major service of ECLS at BIA that involves aircraft turn around operation which is expected to meet industry standard performance in OTP, Safety , data quality and security. The turnaround operation is consist of aircraft maintenance, GSE & staff assignment & scheduling, Aircraft servicing (catering, fueling, cleaning), cargo loading/unloading and aircraft marshaling (taxing, parking).

1.8 Definition of Terms

ECLS: Ethiopian Cargo & Logistics Service (EAG, 2019)

Digital transformation: The utilization of digital technologies to create new or modify existing business process within the value chain and customers experience to meet changing business and market requirement. (Genzorova, 2019)

Key performance indicator: a measurable value that demonstrates how effectively a company is achieving key business objectives. (IATA, 2016)

Ground handling: a process of providing multiple services to passenger or freighter aircraft while it's on the ground at the airport. (IATA, 2018)

Ground handling agent: An entity responsible for the overall coordinated ground handling service at the airport. (IATA, 2018)

Logistics information system: a system with digital records and reports used to aggregate, analyze, validate and display data (from all levels of the logistics system) that can be used to make logistics decisions and manage the supply chain. (PSM WG Meeting, 2012)

Information System Integration: Series of vertical and horizontal interfacing of smooth information flow between business process creating end to end connectivity that can enable optimized operational planning, efficient resource utilization, information transparency and assists in decision making with full control on the events that can affect the performance of service delivery. (ACADEMIA, 2019)

GSE: Ground support equipment which are used to provide multiple support service like loading unloading, fueling, providing ground power, pushback and towing of aircraft during the ground handling operation. (Kovynyov & Mikut, 2018)

Enterprise system integration: is the process of connecting existing systems to share and communicate information. Integrating applications enables data to flow between systems with ease, simplifying IT processes and increasing agility across your business. (MXOTECH, 2018)

1.9 Organization of the study

This study paper is organized in five chapters. Chapter one contains the overall background of the study follow by problem statement and continuous with the research objective & questions along with significant & scope of the study. Both theoretical and empirical, related researches literatures are reviewed along with a working conceptual frame of the study and literature gap within chapter two. Chapter Three discuss the methods of the study starting from research approach & study population to data collection instrument to method to data analysis. Ethical consideration and validity & reliability testing of data collection instruments are included in this chapter. Chapter four consists of demographics data of the respondents, descriptive analysis of variables in regard to their objectives, Inferential statistics both correlation and regression analysis on dependent and independent variables. Chapter five include the general summary of major finding, conclusions drawn from the finding and related recommendations.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

This chapter will discuss on different existing literatures about enterprise's digital transformations, expert's and researcher's opinions and findings on the understanding of digital transformations and the implications on airport aircraft ground handling process with different point of view and process models on the company's supply chain performance & integration. It will also try to frame theoretical or conceptual findings at first, and then review sample empirical observations or results and produce the research's main conceptual framework finalized with noticed literature gaps.

2.1 Theoretical Literature of the Study

2.1.1 Digitization Practices

The outcome of digitization efforts focuses among others on the satisfaction of user needs, new forms of service delivery, and the expansion of the user base. (Mergel, 2019) . As defined by different researchers, digitization is about the changes in an organization's structure, processes, functions, and business models due to the adoption of digital technologies for radically improving its performance. It can lead to many benefits for organizations including improving organizational processes, enhancing customer value propositions, providing better customer collaboration, improving the quality of customer services, reducing the costs of products and services, gaining competitive advantages, and improving customer experience. (Sahu, Deng, & Mollah, 2018)

Another way to look into the mean of digitization (Kovynyov & Mikut, 2018) described it as the use of new digital technologies, such as cloud, mobile, big data, social media and connectivity technologies, to improve customer experience, streamline operations or create new business models (Mergel, 2019) Defines Digitization as a process that is heavily influenced by external drivers, such as the use of new technologies by stakeholders of public administrations. Digitization is a continuous process that needs frequent adjustments of its processes, services, and products to external needs.”

Porter and Millar (1985) asserted that the utilization of information technology has a significant influence on the relationships among value chain activities as well as on the physical aspects of

individual value chain activities. Information technology helps to create and maintain the competitiveness of a company.

Furthermore to the general influence and acceptance of digitization in the current globalized business practice (Frank & Fruth, 2017) has stated that new technologies and concepts such as big data, cloud computing, mobile computing or self-steering processes and services are more and more penetrating the areas of social life and are becoming increasingly important in economic processes. These results in the fourth industrial revolution linked to the term industry 4.0. Industry 4.0 focuses on the linking of industrial processes and technologies, as well as the related business processes with the new information and communication technologies (ICT).

It's also believed that that it has vast potential to facilitate integration and coordination among supply chain partners through the sharing of information on demand forecasts and production schedules that dictate supply chain activities according to s (Gang & Hongjiao , 2009) which ensure it's crucially for business companies to undergo end to end digitization other than individual process automation

2.1.2 Digitization Challenges

Every business company always strives for new way of doing its business in a way that it will improve its position on the surrounding competition and innovation can be a crucial driver in accomplishing the required product or service enhancement. Having the above understanding digitization if deployed carefully can be a perfect enabler to boost companies performance however there are real challenges arise from internal as well as external drivers against the concept.

(Marcus Wolf, Arlett Semm, & Christian Erfurth, 2018) discuss on their case study , the main obstacle towards digitalization with their opportunity includes internal or external drivers for digitization , unclear objective , lack of suitable structure ,cultural challenges , data protection , effect on work , Inter-organizational effect and lack of resources as the major one which in the future, this can also be used to develop a model in which companies can see a guideline for solving fundamental challenges in relation to the Digital Transformation.

Due to the necessity of finding out the preferences of consumers and reacting to them in the shortest time possible, big data analysis of real-time, multi-channel browsing and sales information becomes

a key mechanism for increased efficiency of the design and production phases, ultimately reducing time to market (Marta, Ana, & Vanessa, 2018)

Another interesting fact on the challenges were notice by (Frank & Fruth, 2017) on the digital transformation of maritime logistics is successful if the topics of data protection and data security are given a central role in the implementation strategy. The handling with digital applications and technologies does not only require competent users who are familiar with the digital innovations, but also secure systems that guarantee the protection of the company's internal infrastructure and operating systems from cyber attacks

Digitization has been described in various industries, such as travel, tourism, medical, insurance consumer, high-tech, energy, and education. Digital transformation, also referred to as digitalization, has become a very popular term in academia and industry, yet it lacks a clear definition. New digital technologies are seen as a key driver of digital transformation, but there is no consensus about the impact of digitization on business (Kovynyov & Mikut, 2018).it is necessary to consider digitization as a comprehensive organizational approach rather than one that merely makes forms available online or the transition from analog to digital public service delivery. It will likely result in improved relationships between stakeholders, increased citizen satisfaction, and, most importantly, a change in bureaucratic and organizational culture. (Mergel, 2019)

Other views can dictates on the digitization effects on work taken as challenge (Marcus Wolf, Arlett Semm, & Christian Erfurth, 2018) explained digital Transformation creates a new risk and opportunity in terms of differentiating the level of performance and demands of work.

2.1.3 Aircraft ground operation practices

Airport ground operations, also referred to as ground handling, cover those services required by an airline between landing and takeoff the aircraft, such as marshaling of aircraft, (un)loading, refueling, cleaning, catering, baggage handling, passenger handling, cargo handling, aircraft maintenance, and aviation security services. (Kovynyov & Mikut, 2018) Ground handling not only serves as a crucial sub-system of an airline, as well as all airport operations, but also plays a paramount role in the delivery of the airline's final service to the customer. (Kolukisa, 2012)

Aircraft ground operation value chain refers to the core process at the airside of the airport by the ground handling service providers to the carriers or airlines. This include the below major activities: (Kovynyov & Mikut, 2018) (A) Aircraft Preparation which include the taxing in and out of aircrafts, pushing back and towing of aircrafts, parking of aircrafts, ground power (B)Aircraft Servicing which includes water and toilet service, fueling, cleaning and catering service (C)Cargo handling which includes load planning, unloading and loading of cargo (D)Aircraft Maintenance which includes conducting line maintenance activities on the aircraft for clearance to fly (D)Resource management which includes staff assignment and GSE management .

The ground handling operations represent the airside activities at airports in charge of processing passengers, cargo, facilities and supplies at and around parked aircraft. Most of these operations are performed by different service providers, using vehicles which are specific to each type of operation. (Fitouri-Trabelsi, 2014)

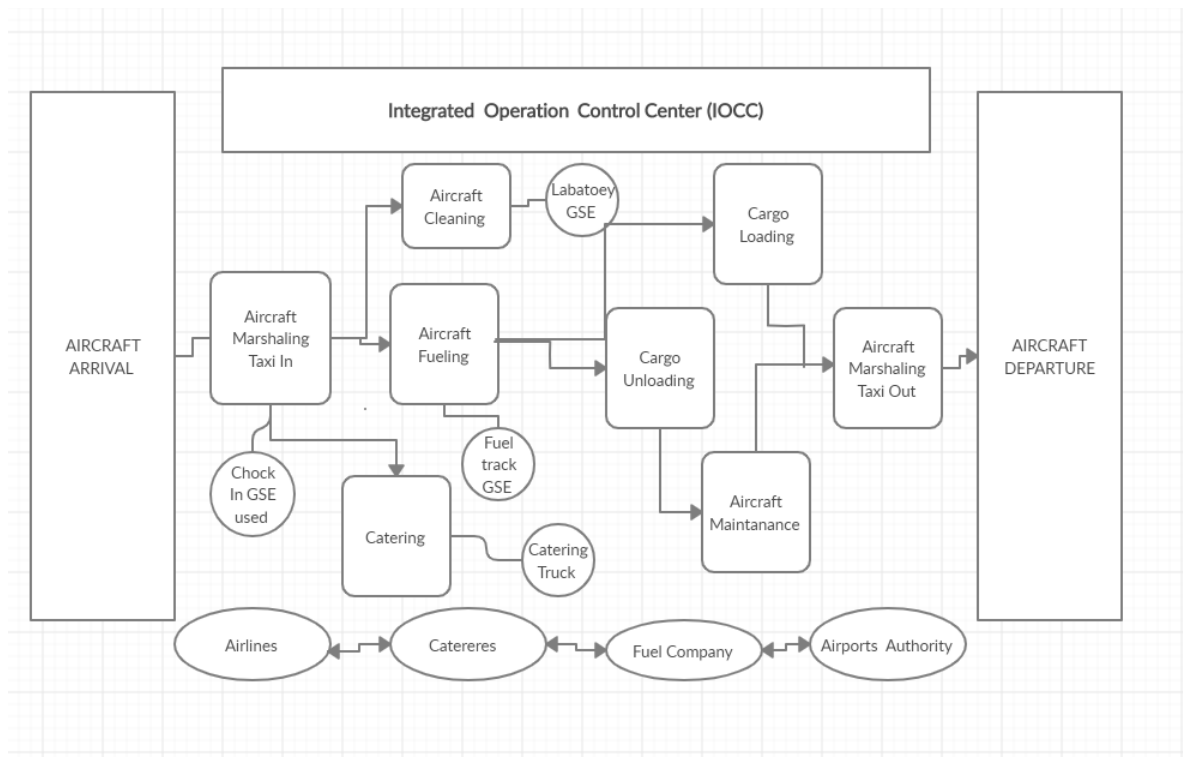


Fig 2.1 Key process of ground operation both at airside of the airport

2.1.4 Aircraft ground operation challenges

(Vagheeswer, 2013) Discuss the turnaround time challenges as the airlines and airport's best interest to get an aircraft quickly to flight since the aircraft generates revenue only when it is on the air. However, the reality is that many times, a departing flight spends considerable amount of time on the taxiway, burning precious fuel, stressing grounding traffic controllers, pilots and Customers cargo.

From overall ground handling operation key performance indicators (KPI), the ones that are considered the most important are (A)On time performance (OTP) (B) Minimize the number of resources (GSE, operators, infrastructure) needed. (C) The predictability for ATM in general and Aircraft Collaborative Decision Making (ACDM) milestones in particular. (D)Aircraft ramp damage avoidance. (E) Avoid personnel incidents and accidents. It is to be noted that some of the KPI are pushing in different directions e.g. minimize resources while respecting OTP. (AlonsoTabares & - Camino, 2017)

Several tasks and activities in airport ground handling are affected by uncertain and random events, e.g. flight delays, utilized capacity insights, weather conditions and technical incidents. In contrast to another industry, the most forecasting and planning models used in the airport ground operations do not consider this kind of uncertainty explicitly. By incorporating uncertainty into planning and forecasting models, we expect a significant increase of the robustness and reliability of developed plans. (Kovynyov & Mikut, 2018)

2.1.5 Digitization practice on Aircraft ground handling

The majority of digitalization initiatives in airport ground operations focus on operational improvements of airport ground operations. In the core processes of the airport ground operations value chain, cost pressures mainly drive the digitalization. The majority of customer-centric innovations contribute further cost reductions to ground handling agents, as well as benefits to the customers through time savings, improved service quality and transparency. (Kovynyov & Mikut, 2018)

Similarly some experience of digitization sought by (Frank & Fruth, 2017) on their maritime logistics analysis research , through smart containers and a suitable networking of single

information systems, it is possible to fully digitize and globally network the entire maritime transport in order to render transparent the respective processes. All terminal vehicles, machines and devices that are involved in the transportation, loading and unloading of goods are interconnected and communicate with each other, which is enabled by means of suitable information, communication and automation technologies. Such an inclusion in higher order systems leads to cyber-physical systems

Globally acting ground handling agents have a large amount of data on sight delays and can use them to optimize flight schedule forecasts by exchanging these data across the local stations. On top of that, collected data may be a powerful resource for a new service offering to the airlines, e.g., passenger preferences for different airlines on the same routes and estimating the potential of promising direct routes to avoid changed flights (Kovynyov & Mikut, 2018)

2.1.6 Supply chain Integration

SCM emphasizes effective and efficient flows of both information and physical items to meet customer requirements, starting from the source of supply of raw materials through to the consumption of the product by the end customer (Gang & Hongjiao , 2009)

As a part of a critical enabler for the overall supply chain management performance, supply chain integration is a linkage between partners across the value chain in term of information, cash and resource on the basis concepts of collaboration and coordination. As explained by (Shapiro, 2001) integrated supply chain management must be data- driven or fact-based if it is to provide the company with competitive advantage. Supply chain managers require timely and accurate information.

Supply chain integration(SCI) within a business shall comprise both internal (information and measurement) and external(customer & supplier) integration .This more explained by (Narasimhan, 2001)as internal and external integration can be accomplished by the continuous automation and standardization of each internal logistics function, and by efficient information sharing and strategic linkage with suppliers and customer .

Successful integration requires fluent flow of accurate and timely information across these supply chain partners. The ability to manage the information flow is one of the critical weapons of today's leading edge organizations. (Gang & Hongjiao , 2009)

Same research also suggested that the results suggest that IT implementation has no direct effect on SCP, but instead that it enhances SCP through its positive effect on SCI. These findings highlight the importance for companies to promote SCI and implement IT as an enabler. (Gang & Hongjiao , 2009)

Thus SCI can be reflected on the supply chain on three parameters , firm to firm collaboration , customer integration and planning & control with indicators of performance measurements dimension which discussed by (HAN, 2018) indicators include operations systems, infrastructure resources and logistics goals such as meeting customer requirements in terms of reliability, information processing, cost, efficiency, and flexibility and responsiveness.

2.1.7 Digitizing and Supply Chain Integration

According to (Gang & Hongjiao , 2009) IT has the potential to manage the information flow and to provide links that support communication and collaboration along the supply chain.

IT serves as a key enabler of SCI through the capture, organization, and sharing of vital information regarding key business processes, both within and outside an organization's boundaries (Clemons, E & Reddi, S, 1993)

Supply chain integration (SCI) is characterized by a situation where members along the supply chain collaborate and work together for better performance and profitability while meeting the demands of the customer. It involves the alignment of business functions internally within a firm and with its supply chain partners so as to reduce costs, increase customer value and overall performance across the supply chain for all partners. (Kumar, 2017)

Industry 4.0 and supply chain 4.0 are crucial because of the introduction of new technologies, robots, automation, Internet of things and computer-aided tools in companies for increasing their performance. The question is how to standardize and elaborate processes of improvement and being sure about the result. Real difficulties for being competitive on the market allow companies to reorganize and improve themselves in order to be innovative, adapted to future challenges. Their supply chain needs to be reminded and has to integrate all new technologies.

It's believed information sharing is the boding line between digitization and supply chain integration as some researcher's discussed it (Gang & Hongjiao , 2009) by making possible the sharing of large

amounts of information along the supply chain, including operational, logistical, and strategic planning data, IT has enabled real-time integration of supply chain partners, provided organizations with forward visibility, and improved production planning, inventory management, and distribution

Supply chain 4.0 integrates use of Internet of things, traceability, robot, cobot, software tools, cloud computing. Then, the company supply chain performance improvement is difficult but necessary for being more efficient in the future. (Eric Dossou, June 2017)

(Kumar, 2017) Proposed as First, in order for a company to enhance its competitiveness, the company has to raise the role of information systems from mere information processing to utilization of technology to change an existing value chain and create a new value chain. Second, in its application to the value chain, information technology should not only automate and improve the physical aspect of value activities, but also create and optimize the structural connection among supply chain activities. These two points have significant implications for IS utilization strategy for supply chain integration (SCI).

Information systems were viewed as providing infrastructural support to the value chain and having an indirect impact on the competitiveness of a product. Companies were able to reduce costs through information systems, but the benefits were not typically apparent to customers. With intensification of competition, firms started to utilize information systems to directly influence the processes comprising the value chain (Narasimhan, 2001)

It's also clearly explained in (Bete Georgise, 2014) in her study, operational efficiency and operational flexibility have direct relationship with SCM information system. The application of ICT enhances the service level of SCM and improves operational efficiency and information quality. The multiple benefits through successful utilization of ICT deliver advantage in both tangible and intangible ways. The selection of the available ICT and cost associated with their implementation is still challenging tasks. Effective utilization of ICT tools will provide the industry a better option in their global supply chain integration efforts, where decisions concerning supply and demand are fully supported by facts.

The main difference between the digitally enabled SCM and the traditional SCM is that “supply chain partners are integrated via information flows rather than ownership. Internet is being used as

one of the main networking platform in the internal and external supply chain through free, open source software. Therefore, information systems for SCM are now implemented using recent advances on IT such as Internet Web services, Application Programming Interfaces (APIs), and software-as-a-service (SaaS) development platforms. This paper, we explore the critical role of information sharing in the link between information quality and supply chain performance. The results confirm that the relationship between information quality and supply chain performance is mediated by information sharing (C. Marinagi, 2015)

Supply chain Integration has emerged as a major field of interest over the years that involve the strategic alignment of functions and processes within an organization. However, there have been major debates regarding the true design of the kinds of integration that would lead to performance of supply chains. Supply chain integration (SCI) is characterized by a situation where members along the supply chain collaborate and work together for better performance and profitability while meeting the demands of the customer. Firms integrating their information and material flow would lead to optimal management of the supply chain. It involves the alignment of business functions internally within a firm and with its supply chain partners so as to reduce costs, increase customer value and overall performance across the supply chain for all partners. (Kumar, 2017)

(Ram , 2001) Illuminated the process of supply chain integration should progress from the integration of internal logistics processes to external integration with suppliers and customers. Internal and external integration can be accomplished by the continuous automation and standardization of each internal logistics function, and by efficient information sharing and strategic linkage with suppliers and customers.

This study aims to make key contributions such as defining key performance indicators through which supply chain integration can be measured. This study defines four constructs of SC integration which are the customer, supplier, internal, and information integration.

Customer integration involves the strategic competencies and activities firms apply in providing optimum services with customers through relationship building. Customer integration builds on the philosophies and activities that develop intimacy and is the competency that builds lasting competitive advantage. Firms have always paid attention to the needs of customers but only recently have begun to identify and consider their differences in terms of capable operational segmentation.

Any firm seeking supply chain integration must also demonstrate strong commitment to the supportive capabilities of relevancy, responsiveness, and flexibility.

Supplier integration refers to the processes and steps involved in sharing information and joint planning with key suppliers to achieve stated objectives and goals of the focal firm with benefits of cost reduction, customer satisfaction and improved lead times. (Kumar, 2017) Supplier integration focuses on capabilities that create operational linkages with material and service providing supply chain partners. While the customer is the overriding focal point or supply chain driver, overall success also will depend on strategic alignment, operational fusion, financial linkage, and supplier management. Competency in supplier integration results from performing the capabilities seamlessly in internal work processes. Firms that desire to excel must blend their operating processes with those of supply partners to meet increasingly broad and demanding customer expectations. (Bowersox, 2002)

Internal Integration has been said to be the foundation of other kinds of integration and is defined as the linkage of business processes of departments in an organization into a strategic fit for improved performance. (Patnayakun, 2002) Internal integration focuses on the joint activities and processes within a firm that coordinates functions related to procurement, manufacture, and market distribution. Many firms have attempted to integrate internal functionality but, as discussed earlier, anecdotal and quantitative evidence strongly indicates there are significant gaps. Managers often report more success in coordinating with customers than with their own manufacturing, logistical, and marketing operations. The capabilities that support internal integration are cross-functional unification, standardization, simplification, compliance, and structural adaptation

Accordingly to Kumar, (Kumar, 2017) **Relationship Integration** is the ability of two or more companies to develop social connections that serve to guide their interactions when working together. Effective relationship management is the final competency essential in supply chain engagements. Successful implementation of supply chain strategy rests on the quality of the basic business relationship between partners. In general, managers are far more experienced in competition than they are in cooperation. (Bowersox, 2002)

Measurement Integration The performance assessment of the supply chain as a whole that also holds each individual firm or business unit accountable for meeting its own goals. Measurement

integration is the ability to monitor and benchmark functional and process performance, both within the firm and across the supply chain. Because each firm is unique, the collaborative effort must define, operationalize, and monitor standard or common measures. Competency in measurement requires the capabilities of functional assessment and activity-based methodologies. Comprehensive metrics and financials impact assessment. (Bowersox, 2002)

Information integration involves the sharing of key information data among supply chain partners through IT systems in order to bring about mutually beneficial outcomes. (Kumar, 2017) This competency includes database access to enable sharing of appropriate information among supply chain participants. It also concerns transaction systems to initiate and process replenishment and customer orders. In addition to information management, it is essential that capabilities related to internal communication, connectivity, and collaboration be developed. (Bowersox, 2002)

Information and communication technology (ICT) is an important enabler for efficient supply chain integration, and many ICT applications have recently gained popularity. This is due to their ability to facilitate, coordinate, and integrate the flow of information across the supply chain. ICT is an enabler which helps supply chain members to establish partnerships for better performance. To mention some of the ICT potential applications in developed country firms, these are electronic data interchange (EDI), Internet and enterprise systems such as enterprise resource planning (ERP) and radio frequency identification (RFID). (Bete Georgise, 2014)

2.2 Empirical Literature of the Study

The research area has a limited sources of empirical literature however the below are found to be important to shade a light on the basic foundation of digitalization implications on air cargo as general and airport and or aircraft ground operation as specific topic of discussion.

2.2.1 Digitization in Supply chain

With the increasing use of computer technology, a greater proportion of recorded information has become digital, as in 1993, only 3% of the world's recorded information was stored digitally, this figure had reached to 94% by 2007 [6]. The better information and transactions are captured and processed, the more systems get equipped with certain degree of intelligence, and the more these

systems communicate with each other through interconnections, the higher is the level of digitization of a network e.g. an entire supply chain or a single logistics process. (Kayikci, 2018)

(Marta, Ana, & Vanessa, 2018) Reflect digitization role in fashion industry with high customer demand variability, as a quick response in the production side, and a dynamic assortment planning with frequent changes. A fast fashion retailer that offers a quick response has a flexible supply chain and can order stock very frequently (not only before each season), taking advantage of any available information from current and potential consumers. However, these companies have higher production costs in comparison with traditional retailers

Over the next decade (2016 to 2025), digitalization in aviation, travel and tourism is expected to: Create up to \$305 billion of value for the industry through increased profitability , Migrate \$100 billion of value from traditional players to new competitors, Generate benefits valued at \$700 billion for customers and wider society through a reduced environmental footprint, improved safety and security, and cost and time savings for consumers ,Result in a net displacement of current jobs in the industry, which is expected to be partially offset by the creation of next-generation skilled jobs inside and outside the travel ecosystem (World Economic Forum, 2017)

Overall levels of digitization were generally at the lower end of the scale. In our study sample thirty eight percent (38%) of the respondents did not realize any revenue from online sales, fifty percent (50%) realized less than twenty percent (20%) of their revenue from online sales, and only twelve percent (12%) realized twenty percent (20%) or more of their revenues from online sales. The extent to which organizations in the study sample have digitized their supply chain activities is shown in Figure 1. Descriptive analysis suggests that organizations are digitizing more intra-organization and outbound supply chain activities in comparison with their inbound supply chain activities. The proportion is slightly higher for outbound activities, where around sixty two (62%) of the organization reports that they are conducting some to all of their outbound supply chain activities online, as compared to around fifty two (52%) for intra-organizational activities. (Patnayakun, 2002)

Digitization through connectivity enables vertical integration from supplier to customer as well as horizontal integration among other competitors and other business partners along the supply chain in order to sustain end-to-end visibility (Connectivity). A digital operating model is all about implementing digital capabilities along the organizational layers of governance, processes, data and performance management, and information technology. It allows for required levels of integration

and standardization of processes (Cooperation). In information technology, logistics systems integration is the process of linking together different computing systems and software applications physically or functionally, to act as a coordinated whole logistics flows. It adds additional value because of interactions between logistics subsystems. Three types of integrations are possible: (1) horizontal integration through value networks, (2) vertical integration and networked logistics systems, and (3) end-to-end digital integration of logistics across the entire value chain. (Integration) (Kayikci, 2018)

2.2.2 Airport Ground Handling Practices & Digitization Challenges

It's suggested in world economy forum, that Airport Collaborative Decision Making (CDM) which tries to create a common ground for the different component of the air transportation system (ATS). This concept is based on an improved communication between the different actors of the airport. As an example, for Roissy-CDG airport, where CDM has been implemented since 2010, departure times are respected in more than eighty-five (85%) of the cases, against eighty percent (80%) before, the ground traffic is more fluid (taxiing times have been shortened by 2 to 4 minutes), a reduction of 14.5 tons of fuel in daily consumption and also a significant decrease in CO₂ emissions. (World Economic Forum, 2017)

The aircraft handling operation at an airport as described in the previous section details the current situation, but is not significantly different to the way it was 10, 20, 30 or even 50 years ago. There have been no major changes in the operation since the beginning of aircraft commercial operation. However, the technology and its cost have evolved tremendously, making possible options that could not be envisaged before. (AlonsoTabares & -Camino, 2017)

Enabling automated handling of the aircraft as we remove some of the tasks that are currently done by humans would have the following benefits: Costs reduction: resource optimization for humans since eighty percent (80%) of ground handling cost is manpower related, Rise of profile for handling staff: from very low-minimum wage profile with high turnover to technical/maintenance people skill profile, Get rid of ergonomic constraints in airport GSE (e.g. loading heights), Security benefit: the less people around the aircraft the less opportunities for threats, Safety benefit: most incidents and accidents are human related. Reduce human induced errors, automate, reporting (key point for

ground handling damage in composite aircraft), Increase awareness of the aircraft status on ground with early detection of performance issues. (AlonsoTabares & -Camino, 2017)

According to white paper from the World Economic Forum indicates that digitization in logistics could provide \$1.5 trillion in value through the year 2025. The digital logistics ecosystem is based on four key enablers: technology, process, organization and knowledge. (Kayikci, 2018)

2.2.3 Supply Chain Integration

Ram explains supply chain management , (Ram , 2001) the control of material and information flows, the structural and infrastructural processes relating to the transformation of the materials into value added products, and the delivery of the finished products through appropriate channels to customers and markets so as to maximize customer value and satisfaction.

The combination of digital and radio-frequency identification (RFID) technologies offers the greatest promise for guaranteeing product traceability across the supply chain and overall sustainability of fashion brands, improving consumer satisfaction. (Marta, Ana, & Vanessa, 2018)

Empirical results show that Customer integration and Supplier Integration have no significant impact on customer Performance and Responsiveness Performance. For quality Performance, however, customer integration was found to be significant. It seems that customer integration plays a major role in generating quality Performance. In the era of mega ship size, cargo data exchange between shipping company and terminal operating company as a case of customer integration strategy contribute to achieve faster turn-around times for ships. Close collaboration between carrier and terminal operator through good communication is a win-win strategy for both parties. One way to achieve this is to rely on joint planning i.e. optimizing cargo flows from end-to-end. Smart joint planning could improve reliability, on-time performance, and cut transportation costs in maritime logistics. (HAN, 2018)

This means that as supply chain integration moves to external integration requiring a high level of integration technology, the utilization of information systems alone cannot maximize the effect of supply chain integration. Closs Earl, and Gustin have expressed the same opinion in that as the application level of IS moves from operational and tactical to strategic, the efficient linkage of IS

strategy with the system's external environments is required. This research provides empirical support to their assertion (Narasimhan, 2001)

Implementing the mobile/web LMIS, alongside people and process interventions, resulted in strong user adoption of the digital information system, low error rates, and enhanced availability of vaccines within the Indian supply chain system. High adoption from the onset, and rapid stability of data quality, were surprising, while supply chain performance improvements took far longer. The data suggest a sequential pattern of sufficient adoption followed by stable data quality, followed by stable supply chain performance. Further research is needed to determine whether this sequencing is consistent across readily scalable digital logistics management information system (LMIS) deployments. (HAN, 2018)

To overcome pitfalls within supply chains (e.g., inaccurate delivery status, inefficient Information systems, and poor coordination (Lee, H. L., & Billington, C, 1992) maintained that integrating databases and control and planning systems throughout the supply chain is needed.

(MICHAEL, C., & D, 2001) Formulated a framework that considered the alignment of a firm's supply chain coordination mechanisms with their inter organizational information systems. They found that firms that align supply chain coordination Activities with their inter organizational information systems tend to perform better than those that do not. In the context of consumer goods, showing the impact on the supply chain performance. Similarly other research indicates that (Rosenzweig, E., Roth, A. , & Dean, J, 2003) empirical evidence has been found to show that the intensity of supply chain integration is linked directly to improved business performance. Likewise, in a study of first-tier automotive suppliers empirically demonstrated those integrative information technologies positively impact supply chain integration, which, in turn, positively influences customer service.

2.3 Conceptual Framework of the Study

A conceptual framework is a visual or written product, one that, “explains either graphically or in narrative form, the main things to be studied, concepts, or variables and the presumed relationship among them (Wilson et al., 2015). The below figure illustrates the conceptual framework of this study. Based on the research questions, literatures and presumed relationship between the digitization and supply chain Integration in Aircraft ground handing, the conceptual framework

underlines the role of digitization practices on ECLS’s Aircraft ground handling supply chain integration. Furthermore, its tried to show the digitization of aircraft handling service with process model approach by aligning each system with the information exchange that will be needed to optimize the operational planning that can result in on time performance, nil aircraft /personnel damage and quality of documentation in the overall supply chain performance.

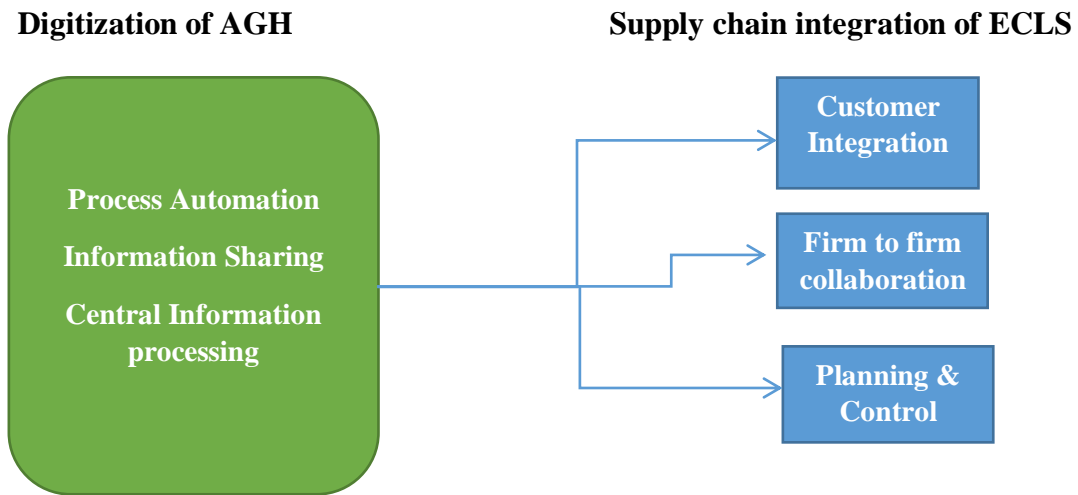


Fig. 2.3 Adopted from Nick (2017) and (Patnayakun, 2002) with Researcher Modification

2.4 Literature Gap

Most of the literatures available in this research area lack to have an explicit detail on the measurement of digitization success on airside operations of ground handling value chain integration with empirical study approach. Researcher in the area seems to focus on specific process automation of aircraft ground handling rather than the integrated digitization of the whole value chain that includes all partners in the supply chain. In addition, results and finding of the literatures are to more general to give the clear implications or impact on the business process output in terms of major supply chain integration indicators. Although there are discussions on adopting new technologies for the formulation of new business models within the ground handling service through streamlined operational excellence, it is limited showing the integration level of the value chain on quantified industry performance indicators. Finally the data set that the studies relies for the generalization of facts and findings is limited to the specific case studies and industries which makes it hard to adopt to the general ground handling business model across the industry.

CHAPTER THREE: METHODS OF THE STUDY

This Chapter will discuss the methodology used for the research which describes research approach, design, population and sample, data source and collection, methods of data analysis, ethical consideration and Validity and reliability test. The research method was selected based on the goals, nature, research topic, and supervisory faculty. A researcher determines how to choose the method to make it more accurate, faster, and cheaper to obtain the answers to research questions

3.1 Description of the study area

Ground handling agents plays a critical role in the air cargo supply chain especially for air freight carriers all over the world and digitization is making it easier to connect major players on both physical and functional level. This research tries to examine major digitization role on aircraft ground handling value chain of ECSL using process model and tries to identify its practices on digitization output in regard with the overall supply chain integration with in customer , supplier , internal process and information flow perspective that can assure service enhancement, operational optimization and new business model creation .

3.2 Research Approach

The research followed mixed approached both qualitative and quantitative approach considering the nature of the study that tries to examine the very nature of the digitization role in ECLS's ground operation in regard to supply chain integration dimensions.

3.3 Research Design

There are different types of research design methods used in similar and related researches like analytical case study, explanatory and comparative studies and most of all descriptive case studies. As the research focus on the investigating the role of digitization practices and challenges with ECLS aircraft ground handling operations in the context of supply chain integration elements, an explanatory research design was chosen. Explanatory research design is useful as the problem and symptoms of limitations in the research area exists with limited knowledge of its features detected. This study meant to explain or elaborate the problem in overall digitization challenge with regard to

the integration level of supply chain partner horizontally as well as vertically at functional and practical level. Thus actually helping the researcher to understand the very nature of what are looking in the situation.

3.4 Population and Sample

The research focus on the digitization of aircraft ground handling process of ECLS at Bole Addis Ababa International Airport Cargo terminal. Due to the focus of the study, only those ECLS's as well as its suppliers or partners (management and non-management) at the airside aircraft cargo freighter operation and assigned process digitization experts from the business transformation section were included as the target population. Thus, the target population was limited to the sections, supplier and customers directly involved with the aircraft ground handling activities from both system development as well as system users side, which is not more than 5 partner group across the value chain with each having maximum of ten (10) staffs that are eligible to be used in this study. The population included only the staffs and management of each section and or company which are operational users or support of the existing system automation for aircraft ground handling process. These categories were chosen due to their position to provide accurate and reliable information based on their expertise and experience about the study as they were expected to be having exposures in the digitization process of the aircraft ground handling. As a result of the small size of population and the research addressed the entire population, census survey method was surveyed used.

3.5 Data Source and Type

Both the primary and secondary data type was used during the data collection stage. The primary data was collected from that specific target group who satisfy the inclusion criteria stated above are while secondary data was taken from the company annual reports and official publications.

3.6 Data Collection Procedure

According to Reza, (Reza , 2019) to create questionnaires, surveyed the literature and conceptual model to identify valid measures for related constructs and adapted existing scales to measure each of the variables, which were first defined.

Accordingly , the collection method included semi –structured questionnaires for operational as well as business transformation experts on the aircraft ground handling process and existing systems functionality observation with supply chain performance & integration parameters. This method is presented in a structured and standard format to keep the data quality persistent with the research objective. Likert rating scale measurement from 1 to 5 is used in the questionnaires for respondent’s indication to their degree of agreement of disagreement. General respondent profile was included in the data collection instrument to identify the desired target group. As *Ghauri explained, (Ghauri & Grønhaug, 2005)* Secondary data has been developed to help to solve the problem in hand and should therefore be relevant, accurate and available. Looking at secondary data is useful not only to find information but also to better understand and explain the research problem. Secondary data is collected from the company’s website, E-journals, e-books and international publications with available and accessible source.

3.7 Method of Data Analysis

This stage was where a mass of data was transformed into to meaningful insights which measure the role of digitization practices in terms of system integration across the value chain at ECLS aircraft ground operation. The researcher used descriptive data analysis techniques like frequency, mean, median, standard deviations and other central tendency measurements as well as inferential statistical analysis which is to be specific Pearson’s correlation & linear regression to measure variables relationship.

The data obtained from the questionnaires were processed using Statistical Package for Social Sciences(SPSS) software application .As proofed by Reza , (Reza , 2019) The structural equation model is a linear model that allows researchers to examine a set of multiple regressions at the same time the study uses a statistical software application called Statistical Package for Social Sciences (SPSS) to process and analyzed the survey data (coded questionnaires and system function reviews).

3.8 Ethical Considerations

The research was undertaken with the consideration of each participant willingness, company's permission and consent to access data and keeps confidentiality, and being compliance with the company's policy on the basis of digital technology standard and procedure. Furthermore, all the reference literature material were acknowledged and quoted in proper manner and the researcher won't have any conflict of interest with the finding of the study.

3.9 Validity and Reliability Test

Quality research is important in producing quality evidence and new knowledge in a subject matter. Research quality is measured by validity and reliability. Reliability is the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects or the consistency of a measurement. And instrument validity ensures that using correct research instrument to accurately measure the variable during the data collection procedures.

This research used subject area expert's feedback on the survey questionnaires and system functionality review methods to measure the internal consistency and validity of intended measurements. The measure was reliable when respondents gave the same answer in different situations. To maintain the validity of the instruments, most of the questionnaires were adopted from previous researches. Some of the questionnaires were developed based on careful review of literatures.

As a part of making the instruments dependable the research uses Cornbrash's alpha range to measure consistency and took 0.7 as a minimum values of Cornbrash's alpha according to previous researches on information technology role on logistics performance (BIZUAYEN , 2019) and approved by (Nunnally, 1978) .

Table 3.1 shows the Cornbrash's alpha values for each variable used in the data collection instrument. As shown on the table the alpha value was more than .07 for each set of variables proving the internal consistence of the data collection instrument which in turn proofs reliability.

Table 3.1 Cornbrash's alpha for variables

No.	Variables	Number of items	Cornbrash's alpha
1	Digitization practice	6	.780
2	Employee's skill	4	.739
3	System Development limitation	2	.972
4	Top management Commitment	2	.776
5	Economic Factors	3	.707
6	Legal Factors	3	.912
7	Technology factors	3	.708
8	Customer integration	4	.717
9	Internal integration	4	.867
10	Supplier Integration	4	.765
11	Measurement Integration	4	.777
12	Information Integration	4	.764
13	Relationship Integration	5	.735

Author's Source: Survey 2020

CHAPTER FOUR: RESULT AND DISCUSSION

This Chapter discuss the results and finding based on the collected data from four major sections (ground Handling or coordinators, suppliers, business transformation experts, aircraft line maintenance) which has be analyzed along with the implications and interpretations, In doing so the researcher use SPSS software analysis tools to evaluate the role of digitization of aircraft ground handling on supply chain integration of Ethiopian Cargo & Logistics Service ,from 40 respondents according to the methodology stated in the above chapter .

4.1 Demographic Data Presentation and Analysis

The research try to reach all target population who are eligible based on the inclusion criteria on each expertise from each section however due to the current pandemic situation the ground handling has been very busy with tight schedules hence the researcher tries to get at least the minimum respond from each task to make the study complete in its data sure distribution.

Knowing the general profile and characteristic of the respondents will make it easier for the readers to understand the data analysis and interpretations,

Table 4.1 Demographic Analysis

Demographic profile of the respondent	Dimension	Frequency	Percent
Respondents Gender	Female	39	92.9%
	Male	3	7.1%
Age	<25 Years	1	2.4%
	25 -35 years	37	88.1%
	36-45 Years	4	9.5%
Marital Status	Single	23	54.8%
	Married	19	45.2%
Educational background	Diploma	1	2.4%
	BA	35	83.3%
	MA	6	14.3%
Work Experience	<5yrs	14	33.3%
	5-10yrs	19	45.2%
	11-15yrs	5	11.9%
	>15yrs	4	9.5%
Working section /Department	Business transformation expert	13	31.0%
	Loading and unloading coordinator	20	47.6%
	A/c line maintenance	9	21.4%
Role in your departments	System user	31	73.8%
	System developer	6	14.3%
	Operational System support	5	11.9%

Author's Source: Survey 2020

Gender: the gender distribution of the sample population is shown as above, implicating most of the respondents were male (92.9%).

Age: The age distribution of the sample population is shown as per above, implicating that most of the respondent's age fall between 25 and 36 which is group 2 (88.1%)while zero respondents from The above 45 years' group which shows with a moderately young employees and good for technology adoption.

Marital Status: The marital status of the sample population is shown as per above, implicating a relatively balanced measure.

Educational Level : The respondent's educational levels shows a very small difference as most of them to be BSc holder (83.3%) and a small amount of MSc holders (14.3%) among the population .This indicates respondents have good academic qualification and have had an exposure to Information technology easily .

Work Experience: The respondents work experience on the company was evaluated starting from 1 year to above 15 years and have the distribution as per above with a major of experience of respondents falls between 5 and 10 years (45.2%). This shows the respondents had enough experience to understand the questions with regard to their role in the operation and their response can be taken genuine.

Section: The respondents working section distribution was captured as a means to evaluate the intended sample population is captured. Thus among five groups of sections focus were given and major responses were gotten from loading /unloading coordinator (47.6%) and business transformation experts business transformation experts (33%),as shown above which is good for the research to capture the actual and practical data from the very front line staffs

Role: The respondent's role was associated with their departments however specific knowledge about each role on the value chain makes easier for further analysis .Hence, as the study focus the system users which includes major players in the process has been seen as major respondents (73.8%) whereas the enough respondents from developer's (14.3%) side were collected to balance the other effect of digitization (developer side).

4.2 Descriptive Analysis

Mean or media and standard deviation are the measurement of central tendency and dispersion or variability of given data. The researcher uses SPSS to run frequency and descriptive on each group of variable to understands the descriptive coefficient measurement to the role of digitization on supply integration and factors on digitization.

The mean statistical values of the items were based on the 5 point Likert scale and will be illustrated through the following assumptions: if the mean (M) score is below 2.5 it implies that the respondents" disagree with the statement, if the mean score is between 2.5 to 3.5 it indicates that the respondents" prefer to stay Neutral on their preference, and finally if the mean score is above 2.5 it implies that the respondents" agree with the statement.

4.2.1 The Digitization Practice of ECLS’S Aircraft Ground Handling

Major Aircraft activities were identified to measure their level of digitization practice on practical base throughout the value chain.

Table 4.2 Major AGH activities digitization practice

Major AGH Activities	N	Mean	Std. Deviation
Digitization practice on Aircraft marshaling	42	3.05	1.396
Digitization practice on Aircraft servicing (Fuelling, catering , cleaning)	42	3.19	1.330
Digitization practice on Aircraft line maintenance planning	42	4.12	.968
Digitization practice on flight data preparation	42	4.07	.921
Digitization practice on cargo loading and unloading	42	3.52	1.087
Digitization practice on GSE & staff assignment and scheduling	42	3.33	1.203
Valid N (list wise)	42		

Author’s Source: Survey 2020

The responses were measured using the Likert scale 1 up to 5, indicating the extent of agreement to the questionnaires. In the above summarized result of digitization practice of ECLS’s aircraft ground handling major activities, the mean value up to 3.5 shows the respondent agreement to partial accomplishment of digitization process on the specific practice of the AGH whereas mean value above 3.5 shows strong agreement that the practice has been fully digitalize at all levels of operation . As per the above table result, digitization practice on aircraft marshaling process, GSE & staff assignment and scheduling and aircraft servicing activities are still have limitations (mean value of 3.05 ,3.33 and 3.19 respectively) or the respondents aren’t confident that those process have the ability to be said fully supported with information systems that can streamline and integrate along with other process across the supply chain .In the contrary digitization practice on aircraft line maintenance planning , cargo unloading and loading planning and flight data preparation are believed to satisfy the level of fully digitization process with the average mean value of 4.12, 3.52 and 4.07 respectively .

The above finding preliminary indicated that the whole ground handling value chain still have limitation on end to end digitization with some of the activities only undergo simply process

automation without being evaluated on how they have to be integrated with other major activities to ensure the over supply chain integration .

4.2.2 Factors Affecting the Digitization of Aircraft Ground Handling

This section presents major factors that can extremely influence the digitization process of the aircraft ground handling value chain at ECLS in terms of delivering the requires integration both horizontally and vertically across supply chain partners.

4.2.2.1 Internal Factors

Internal factors that the researcher identifies to be play the role on digitization of AGH process includes employee’s skill & technology acceptance, developer’s limitation on operational business requirements and lack of top management commitments .The below table shows the mean and standard deviation value for internal factor variables for further interpretation.

Table 4.3 Internal factors on role of digitization

Factors	Dimensions	N	Mean	Std. Deviation
Employee’s skill & technology acceptance	System user’s lack of technical and IT knowledge	42	3.55	1.131
	System user’s fear for technology acceptance	42	3.74	1.061
	Inadequate training on system utilization	42	3.64	1.122
	Lack of system user’s commitment on IT knowledge development	42	3.69	1.070
Grand Mean			3.655	0.84275
System developer’s limitation to business requirements	System developer’s understanding of operational issues is low	42	3.67	1.300
	System developer’s knowledge level on AGH business process is low	42	3.52	1.254
Grand Mean			3.59	1.25
Lack of Top management Commitment technology dependability	Company’s top management commitment for AGH digitization initiatives is limited	42	3.74	0.912
	Company’s top management’s underestimates the economic benefit of AGH digitization	42	2.98	0.749
Grand Mean			3.35	0.646
	Valid N (list wise)	42		

Author’s Source: Survey 2020

As per the above result Respondents clearly agree the existence of internal challenges on the deployment of AGH digitization even if the extent is different from dimension to dimension.

The first factor which is employee's skill and technology acceptance has an average mean of 3.65 and standard deviation of 1.096 where employees fear to technology acceptance take the highest value for 3.74 and employee's skill on the IT knowledge to have the least value 3.55. Over all the implication shows employees have a limitation on system utilization and lack training or support from system's functionality in order to utilize system efficiently that can contribute on the process of digitization

The second factor discuss on the developer's limitations to understand operational requirements while deploying required operational process automations. Respondent's shows a strong tendency to the limitation of developer's understanding of operational requirements with mean value of 3.59 and standard deviation of 1.22 implying the concern is valid and supported.

The last factor regarding the top management commitment on digitization process has a mixed respond as the respondent seems to agree on the top management commitment limitation on IT initiatives with mean value of 3.74 while they disagree on top management's underestimation of economic benefit of AGH digitization with mean value of 2.98. This indicates that the ECLS's top management believes on the digitization benefit of efficiency and operational excellence however still have a limitation to encourage adoption of best in practice digitization model for AGH .

4.2.2.2 External factors

This section discuss the result associated with the external factors that are assumed to influence the digitization process of AGH from political, economic and technological dimensions. The below table shows the descriptive coefficient result on each dimensions.

Table 4.4 External factor on role of digitization

Factors	Dimensions	N	Mean	Std. Deviation
economic factors	AGH digitization in the value chain is costly	42	3.95	.731
	AGH digitization is impacted by lack of enough budget	42	3.74	1.127
	AGH digitization will incur huge maintenance and monitoring	42	3.62	.962
Grand Mean			3.77	0.770
legal factors	AGH digitization is affected by the working legal framework of stakeholders	42	3.50	.969
	AGH digitization is affected by the legal system of nations.	42	3.71	1.019
	AGH digitization is affected by the capability of legal expertise in understanding Information systems	42	3.90	.878
Grand Mean			3.70	0.893
Technology factor	Lack of modern ICT infrastructure(physical & virtual) in the country affects the AGH digitization	42	4.07	1.177
	Lack of sustainable power affects the AGH digitization	42	3.86	.843
	Poor deployment and implementation of individual systems affects the AGH digitization	42	4.10	.932
Grand Mean			4.00	0.748
	Valid N (list wise)	42		

Author's Source: Survey 2020

The overall mean and standard deviation of external factors are 3.81 & 0.96 respectively, indicating the respondents agree on the highly existence of external influence on the digitization process of AGH.

Among the economic factors ,digitization cost of value chain with mean value of 3.95 and standard deviation of 0.731 believed to influence the most while the other two ,lack of budget with mean value of 3.74 and maintenance & monitoring cost with mean value of 3.62 reflects similar agreement with slightly low extent .Thus the researcher can conclude ECSL's digitization can have a real critical influence from economic factors on its AGH digitization process which can be considered as a competitive advantage in the industry hence needs a mitigation plan to provide alternative approach and solution .

Similarly legal factors have a mild influence on the digitization process as per the above result with an average mean value of 3.7 and standard deviation of 0.95. The tendency of legal experts to lack the required understand of working environment of information system takes the major influence with mean value of 3.9 as per the respondents .which indicates a miscommunication on the acknowledgment of the existing digitized process from ECLS's legal experts .

The third and the highest influence among the external factors is technological dimension which compromised the technical issues in the digitizing process with the average mean value of 4.01 and standard deviation of 0.986. Poor physical infrastructure to run the systems with Mean value of 4.07 and limitations on integrating standalone automated process (with a mean value of 4.10), in a way that can help to ensure information integration across the value chain.

4.2.3 Digitization of Aircraft Ground Handling on Supply Chain Integration of ECLS

This section discusses the role of digitization of aircraft ground handling on each one of the supply chain integration dimensions in the context of ECLS. Respondents were asked to show their extent of agreement using the Likert scale of measurement. The below table shows the overall result based on the mean and standard deviation of individual variables as well as grouped in each dimension .

Table 4.5 Role of digitization on the supply chain integration dimensions

Dimensions	Variable	N	Mean	Std. Deviation
Relationship integration	Responsiveness with stakeholders & Customers	42	4.50	0.506
	Reliability of sharing of data across value chain	42	4.40	0.627
	Flexibility in creating functional visibility and transparency across the value chain	42	4.33	0.754
	Coordination Cost reduction	42	4.36	.656
	Assists to resolve performances conflicts	41	4.24	.759
Grand Mean			4.37	0.478
Customer Integration	Responsiveness to customer integration	42	4.31	.841
	Flexibility customer integration practices,	42	4.26	.587
	Reliability to customer integration	42	4.21	.750
	Cost of customer integration practices	42	4.17	.660
Grand Mean			4.24	.576
Internal Integration	Responsiveness to its internal integration practices	42	4.36	.533
	Reliability information sharing platform	42	4.52	.552
	Flexibility of cross functional planning	42	4.60	.544
	Cost of common compliance & standardization	42	4.43	.547
Grand Mean			4.48	0.461
Suppliers Integration	Responsiveness to its supplier integration practice	42	4.19	.634
	Reliability to its supplier integration practice	42	4.26	.665
	Flexibility of information sharing with suppliers	42	4.31	.604
	Cost of information uncertainty and transaction frequency during communication with suppliers	42	4.02	.780
Grand Mean			4.20	0.511
Measurement Integration	Responsiveness to its measurement integration	42	4.21	.782
	Cost to its measurement integration practices	42	4.02	.643
	Flexibility to indicate financial impact assessment	42	4.19	.707
	Reliability in enabling easy benchmarking	42	4.12	.772
Grand Mean			4.14	0.569
Information Integration	Responsiveness in sharing accurate information	42	4.40	.767
	Connectivity among company's individual functional systems	42	4.43	.668
	Reliability in enabling centralized information sharing	42	4.55	.593
	Reduce system interfacing costs across the value chain	42	4.10	.790
Grand Mean			4.37	0.533

Author's Source: Survey 2020

Almost all respondents' shows a strong agreement towards the role of digitalization on each dimensions of the supply chain integration assuring that a complete integration of individual information system across the value chain of ground handling can have huge impact on the level of supply chain integration.

Among the dimensions, internal and information integration was believed to be more positively influenced by the digitization process with a mean value of 4.447 and 4.37 respectively. In addition they also have a standard deviation of 0.546 and 0.7045 respectively which shows that the data is more concentrated to the mean value. As it can be shown on the table, flexibility on a cross functional planning, and reliable centralized information sharing among partners are the major dependent variables with mean value of 4.6 and 4.55 respectively that are highly benefited from the digitization process of the aircraft ground handling.

The other four integration dimensions, relationship (average mean value 4.33), supplier (average mean value 4.19), customer (average mean value 4.23) and measurement (average mean value 4.13) shows similar positive response with slightly less value. Efficient and flexible communication, data sharing among partners is the major variable with the highest mean value of 4.5 in relationship integration. Flexibility within common information sharing between suppliers is among the most influenced (mean value of 4.31) dependent variable within supplier integration dimension whereas Effective and responsive communication with customer with customer integration dimension is the highest positively affected variable (mean value of 4.36) by the independent variable digitization of AGH process. Measurement integration are also shown a positive indication of agreement with slightly less mean value(4.135) from the rest of integration dimension especially the flexibility to indicate the financial assessment of the company can highly affected through digitization .

Furthermore , in order to understand the digitization role on supply chain integrations dimensions with respect to their performance elements the researcher provide the below summary of table showing mean and standard deviation of cost , responsiveness , flexibility and reliability .

Table 4.6 Supply chain integration performance dimensions

	N	Minimum	Maximum	Mean	Std. Deviation
Cost	42	3.67	5.00	4.1825	.43835
Responsiveness	42	3.50	5.00	4.3294	.49179
Flexibility	42	3.67	5.00	4.3532	.39338
Reliability	42	3.67	5.00	4.3452	.42195
Valid N (list wise)	42				

Author's Source: Survey 2020

As it can be indicated on the above table, the entire performance dimension's mean is above point 4 showing the respondents agreement to the positive influence of digitization role. Timely responsiveness on each elements of integration has shown a mean of 4.33 with 0.49. This can be seen most in the customer dimensions as its support to make all operational process within the value chain to be responsive to all customer requests with no time delay as stated by (HAN, 2018) close collaboration and information sharing activities with key customers that provide the firm with strategic insights into market expectations and opportunities ultimately enabling a more efficient and effective response to customer.

Flexibility with each dimensions are responded positively with mean of 4.35 and standard deviation of 0.39 which was the highest among all. As explained in (Patricia M, Soumen , & Nagesh , 2008) T integration enables a firm to tap its supply chain flexibility which in turn results in higher supply chain agility and ultimately higher competitive business performance. This implies that respondents agree in the flexibility outcome of applying digitization in the AGH value chain to enable integrated planning and supplier interaction less complicated. Reliability is the second most positively agreed performance dimensions each elements of the supply chain integration by the respondents with mean value of 4.34 and standard deviation of 0.42. This specifies that shared information and common database through digitization are reliable among customer and supplier group across the value chain of ECLS's AGH.

Last but not least Cost performance measurement of the supply chain integration have a slightly lower agreement level compared to the other three but still with mean value of 4.1 and standard deviation 0.43. This also indicates that the respondents were agreed on the cost reduction implications of digitization role. Cost of customer or supplier integration in terms of resource as

well as provision of services can be mentioned as a major improvement area by digitization. The above point agreed with (Ram , 2001) on the use of advanced information systems in value chain activities allows companies to enhance competitive differentiation as well as cost leadership and sustainable competitive advantage.

IT has also proved to be an effective means for decreasing both coordination costs, including the Direct cost of integrated decisions and transaction risk, which is the risk of being exploited in the relationship (Clemons, E & Reddi, S, 1993)

Over all , the above survey indicate us that the role of digitization of AGH process can have an impeccable impact in the ECLS's supplier chain integration in terms of flexibility to customer demand , information sharing among partners , reduction of general service cost and operational efficiency through internal process integration . According to Kumar (Kumar, 2017) a firm's ability to integrate its processes internally and externally with its supply chain partners aid its ability to respond to the changing demands of the customer. Although firms have faced major challenges in integrating their supply chains internally and with other supply chain partners

4.3 Inferential Statistics

4.3.1 Correlation

As a measure of relationship between variables correlation is the most known inferential statistics tools. As decried by (Berhane, 2019) correlations was the measure of the linear relationship between two variables. A correlation coefficient has a value ranging from -1 to 1. Values that are closer to the absolute value of 1 indicate that there is a strong relationship between the variables being correlated whereas values closer to 0 indicates that there is little or no linear relationship. Further to the above, (Yafet, 2018) also details the correlation is a commonly used measure of the size of an effect: values of ± 0.1 represent a small effect, ± 0.3 is a medium effect and ± 0.5 is a large effect. In this section, correlation analysis conducted in the light of each research Objectives and questions developed

We consider the digitation role of Streamlined or integrated automation, common information sharing and central information processing capability on each AGH business process as an independent variable and the dimensions of supply chain integration as a dependent variable. The below table demonstrate the correlation among independent and dependent variables within and

each other.

Table 4.6 Pearson’s Correlation among Supply chain integration group and digitization role

Correlations							
		Customer Integration	Planning & Control	R/ship Integration	Automation	Info Sharing	Central information processing
Customer Integration	Pearson Correlation	1	.606**	.347*	.210	.502**	.420**
	Sig. (2-tailed)		.000	.024	.181	.001	.006
	N	42	42	42	42	42	42
Planning & Control	Pearson Correlation	.606**	1	.688**	-.054	-.044	.130
	Sig. (2-tailed)	.000		.000	.733	.783	.411
	N	42	42	42	42	42	42
R/ship Integration	Pearson Correlation	.347*	.688**	1	.018	-.044	.121
	Sig. (2-tailed)	.024	.000		.912	.780	.444
	N	42	42	42	42	42	42
Automation	Pearson Correlation	.210	-.054	.018	1	.610**	.460**
	Sig. (2-tailed)	.181	.733	.912		.000	.002
	N	42	42	42	42	42	42
Info Sharing	Pearson Correlation	.502**	-.044	-.044	.610**	1	.510**
	Sig. (2-tailed)	.001	.783	.780	.000		.001
	N	42	42	42	42	42	42
Central information processing	Pearson Correlation	.420**	.130	.121	.460**	.510**	1
	Sig. (2-tailed)	.006	.411	.444	.002	.001	
	N	42	42	42	42	42	42
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Author’s Source: Survey 2020

The Above table shows the correlation among the supply chain dimensions as well as the indicators of digitization role on AGH practice. As a result the relationship among the supply chain elements based on the digitization role is very strong.

As per the above table, customer integration seems to have a strong significant relationship with

other supply chain elements and information sharing role of digitization with r value ranging between 0.420 and 0.522 , and $p < 0.05$. Internal integrations shows a strong significant relationship with customer ,supplier and measurement elements of the supply chain dimensions based on the digitization role of automation , information sharing and central information processing with r value between 0.356 and 0.667 , and $p < 0.05$.

Supplier integration have a strong and significant relationship with other elements especially with internal and information integration with r value of 0.667 and 0.662, $p < 0.05$ respectively. It's also have a strong relationship with the two roles of the digitization , information sharing and central information processing capability with r value of 0.444 and 0.372 , $p < 0.05$ respectively .

Measurement integration shows a stronger significant relationship with relationship and information integration with r value of 0.777 and 0.583, $p < 0.05$. The above table didn't show direct strong relationship between the measurement integration and digitization role elements although it's highly related with other supply chain dimension's digitization practice significantly, $p < 0.05$.

Information integration shows a strong relationship with other elements of supply chain integration. Supplier and measurement integration with their digitization practice have a strongest relationship with information integration with r value of 0.662 and 0.583, $p < 0.01$ respectively. In similar ways relationship integration have the strongest relationship with measurement and information integration with their digitization practice (r value 0.717 and .500, $P < 0.01$) and slightly strong association with customer integration with r value of 0.344 and $p < 0.05$.

In general observation from over all supply chain integration element groups , customer integration including (supplier , internal and customer) have more direct relationship with role of digitization while the other two groups which are firm to firm collaboration (relationship integration) and ,planning & control (information and measurement integration) are indirectly related with the digitization role based on the other elements fulfillment with respect to the digitization practice .

4.3.1 Regression analysis

As it's explained in the literature part of the study, the role of digitization on the supply chain integration is impeccable and significant. In order to understand this with actual demonstration, meaning how the independent variable (role of digitization) can control and explain the dependent variable (supply chain integration) simple linear regression analysis was applied to applicable

variables. The model summary and regression coefficient tables are presented as follows on the below tables.

Table 4.7 Regression coefficients for role of digitization

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.512	.457		5.498	.000
	Digitization role	.443	.112	.530	3.953	.000

a. Dependent Variable: Supply chain integration (customer group)

Author's Source: Survey 2020

Table 4.13 shows that digitization role have a clear association and impact on the supply chain integration of ECLS's AGH with $b = 0.530$ and $p < 0.05$ supporting the hypotheses that digitization have a positive influence or impact on the company's supply chain integration in all types of elements .

Table 4.8 Model Summary for dependent variable Supply chain integration

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.530 ^a	.281	.263	.37387	1.353

a. Predictors: (Constant), Digitization role

b. Dependent Variable: Supply chain integration(Customer integration group)

Author's Source: Survey 2020

Table 4.14 clearly shows that the adjusted R implies that 26.3% of variation in ECLS's AGH supply chain integration can be attributed by the digitization role of the AGH business process, meaning the other 73.7% changes in ECLS's supply chain integration will be attributed by other factors. In other

case, we have a normalized measure of independency in aim for the test of assumption validity with 1.353 Durbin-Watson values not less than 1.

The below graph plots the standardized values our model would predict, against the standardized Residuals obtained. As predicted the scatter plot is elliptical with no pattern (randomness of the data) fulfilling the assumption requirement.

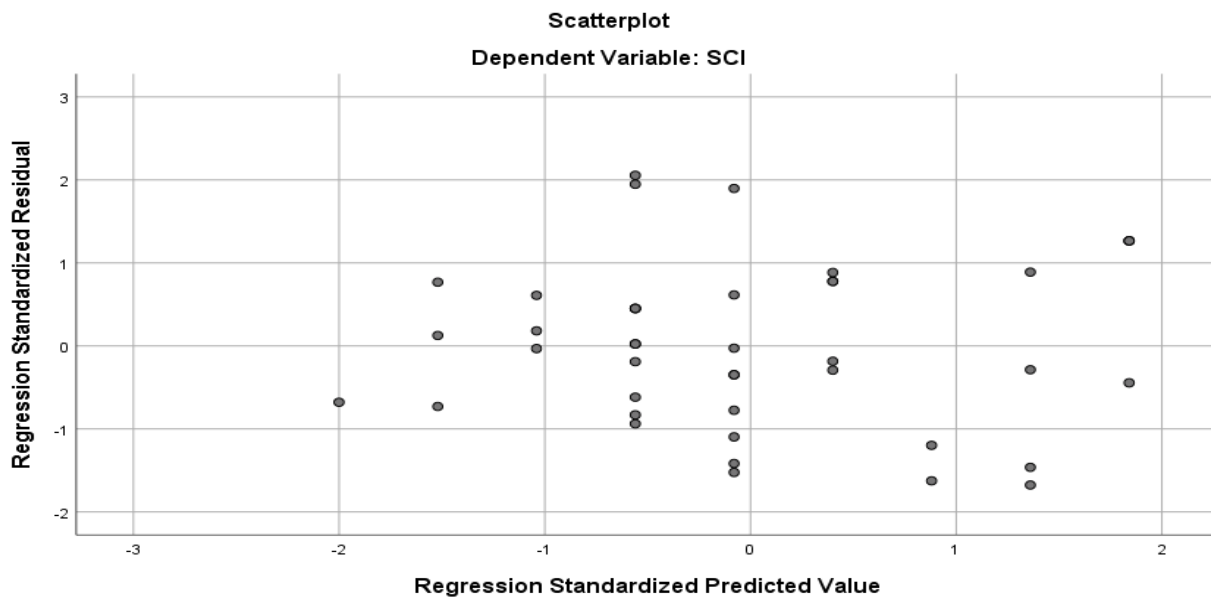


Fig 4.1 Scatter plot for dependent variable

Table 4.9 Result of regression analysis (ANOVA)

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.184	1	2.184	15.626	.000 ^b
	Residual	5.591	40	.140		
	Total	7.775	41			
a. Dependent Variable: Supply chain integration						
b. Predictors: (Constant), Digitization role						

Author's Source: Survey 2020

The above table explains how the dependent variable can be chosen as a preferable measurable variable to the dependent variable better than the mean square value. As the result the digitization's role can be considered as the significant predictor for supply chain integration of ECLS's AGH with p value is <0.05 .

The General observation here is that digitization role of information sharing and central information processing power can be an influence to the changes in the supply chain integration, specifically in the customer integration group consisting of internal, customer and supplier integration of ECLS's aircraft ground handling services to increase efficiency, flexibility and responsiveness. The rest of the supply chain integration elements, firm to firm relationship (relationship integration) and planning and control (information and measurement integration) will be satisfied more in digitization process after the customer integration sub group has been stratified.

The above inferences are also supported with the correlation results as the digitization role in AGH is more directly related with the customer integration and have a moderately indirect relationship with the other elements however the customer integration have the strong association with the planning and control , and firm to firm relationship sub group with r value of 0.666 and 0.377 respectively which show the interdependency among the sub groups of supply chain integration when the value chain undergoes through digitization process .

The other point is among the factors affecting the digitization role the external factors has been identified to influence more than internal factors within the ECLS's aircraft ground handling indicating the company is doing excellent work in minimizing internal ICT deployment risks. This point shared with (Marcus Wolf, Arlett Semm, & Christian Erfurth, 2018) as discussed that successful companies are characterized by 1. A change of mentality in the management, 2. Creating the preconditions for an innovative area and 3. Promoting the exchange of knowledge and data within the company.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

In this section the researcher discuss the summary of the result and discussion part with major finding in general, draw conclusions based on the findings to each research questions stated in chapter one and implicate practical recommendations for improvements as well as to the academic community for further research on the subject matter .

5.1 Summary of Finding

The main concern of the study is measuring the digitization role in Aircraft ground handling on the overall supply chain integration of ECLS within the airport value chain while identifying the major challenges of digitization role that hinder the end to end deployment.

1. As per the study result on over all digitization practice of the company among the major activities of ECLS's AGH flight data preparation & aircraft maintenance planning seems to have a better digitization out while Aircraft Marshaling and GSE & staff assignment and scheduling needs improvements in its digitization practice to support the aircraft turnaround operation in time and cost efficient way. The respondents clearly agree positively to overall the digitization practice slightly positive with mean of 3.67 and standard deviation of 0.770 however opportunities for improvements on end to end process alignment along each digitization shall be noted as to have the better success factor on the overall all supply chain integration .
2. The study identifies that both internal (mean=3.57) and external factors (mean=3.83) influence the digitization role of AGH .Employees skill and technology acceptance take the lead within the internal factors with mean value of 3.65 and standard deviation 0.8427 which indicates digitization shall be a fully package considering employees readiness and qualification for utilization. The respondents agree more positively on the external factors that limit the level of digitization however technological factors take the credit more with mean value 4.00 and standard deviation 0.748. ICT infrastructures and sustainable power to make the information sharing or flow 24/7 are critical to the outcome of digitization role in the ECLS's AGH.
3. The other major point that the study revealed is the digitization role of AGH on the supply chain integration of ECLS. The respondents in general agree that digitization can be significant influencer on all the supply chain integration elements. The result shows measurement

integration with mean value for 4.14 and standard deviation of 0.569 as a minimum and internal integration with mean 4.48 and standard deviation of 0.461 as maximum level of agreement while the rest fall between this two. The study also identify the four dimensions of supply chain integration performance as Responsiveness , Flexibility and Reliability with the same mean value of 4.33 and Cost dimension with 4.1 indicating that performance measure can be attainable due to the digitization role of the AGH in ECLS .

4. Finally the Correlation and regression analysis result shows that portion of the digitization practice , information sharing and central processing power ,can highly influence the supply integration group of the supply chain integration consisting of internal , supplier and customer integration dimensions with $p < 0.05$ $B = 0.443$ and $r = 0.530$. The other elements have a significant strong relationship with the customer integration elements however no direct association can be found with the digitization practice from result.

5.2 Conclusion

According to the respondents the general digitization role of aircraft ground handling in the supply chain integration of ECLS is moderately high. The study also discovers that all the performance measurements are positively affected by the digitization role. Although the digitization practice has been found to have direct influence (23%) on only the customer integration part of the company's supply chain integration, the customer integration dimension has a direct strong positive influence on the other two which are firm to firm collaboration and planning & control dimensions.

The overall digitization practice of the AGH seems to be moderately high per the respondent's perception. Flight data preparation and aircraft maintenance planning have a the better side of the result with information sharing & central information processing dimensions of digitization role while aircraft marshaling and GSE & staff assignment and scheduling only undergo automation process with integrated with other activities . Cargo unloading and loading have a moderate positive result in regard to the digitization practice based on the information sharing and automation of process as per the respondents perception.

The external factors affecting the digitization role has been found a strong positive result. The cost of digitization in economical factor , the legal departments knowledge of digitization outcome understanding , insufficient physical infrastructure to support the overall digitization and over automation of process without alignment with customer or supplier demand are the major factors identified from the respondents. Even if it's not like external however internal factors are also believed to influence the digitization role moderately as per the perceptions of the respondents. System user's fear of technology, commitment to IT skill developments and lack of system development's teams understanding the practicality of operational business process makes it difficult to the digitization process to meet the target. On top on this ECLS top management understand the economic benefits of digitization but still have limitation to encourage o digitization initiatives as per the respondents thus need further investigation for clarification on this factor .

Finally the study discovers that the digitization practice of the AGH have a direct significant strong role on the customer dimension ($B=0.443$ & $p<0.05$) consisting of internal, supplier and customer elements of supply chain integration in ECLS while firm to firm collaboration and Planning and control dimensions have a direct weak association with the digitization practice of AGH per the regression analysis result. However, the study also finds out that firm to firm collaborations are effect of the customer integration ($B=0.38$ & $P<0.05$) and Planning & control dimensions show similar out come with $B=0.682$ & $p<0.05$. This indicates the current digitization practice delivers direct impact that customer parameters across the aircraft ground handling value chain in regard with real time information sharing and central information processing capability while the other two dimensions are affected indirectly. This needs further investigation to find out the association better and understand linkage.

5.3 Recommendation

Based on the overall data analysis, finding and conclusions stated in the above the researcher point out the below recommendation.

- ❖ ECLS shall check the major activities of AGH for process alignment and find a way to establish a platform for individual process automation within the value chain to communicate and exchange information to enable end to end digitization from customer to supplier end.
- ❖ ECLS shall develop a different approach for employees familiarization to digitization business process at the early stage of deployments while making the system developers to do a standard business process requirement within or cross functional departments of partners in the value chain before modeling and adopting ICT application in order to improve the digitization role in internal as well as external integration.
- ❖ Digitization capability must developed from inside the company to reduce cost of ICT application adoption as well as sufficient physical IT infrastructure must be designed prior undergoing the digitization process to prevent disruption of information flow across the supply chain.
- ❖ ECLS shall develop a digitization road map for the entire AGH service with customers like airlines and airport authorities as well as supplier like ground service providers to capture the input/output relationship with the common understanding of performance parameter in terms of response time, cost efficiency, strategy flexibility and data reliability.

5.4 Potential limitation

The study has encounter major setback during the course of conducting the research which is the current COVID-19 global pandemic. The pandemic has cause limitation to the study in two directions. The first one is, most of the target population in ECLS at bole international cargo terminal was neither unavailable nor has time to give the responses due to the highly pressurized operational demand on air cargo industry. Hence the data collection has not met its target as planned in the expert group as well as volume and validity of the respondent's response. The second limitation was the time constraint given the current situation and movement lockdown as most of the institutions including the AAU was suspended for service for a certain time. In addition to the

above the researcher faces a difficulty finding enough literature on the subject matter in developing countries like Ethiopia within the given time.

Implication for future research

- ❖ As the research was focused on ECLS's ground operation internal function and ground suppliers due to its evitable limitations as stated above, it's recommended that digitization role across the entire air cargo supply chain involving carries and regulatory bodies in order to get a broader understanding of the problems and impact of digitization on the entire value chain integration performance.
- ❖ For the subject to be generalized , its advisable similar investigation to be done with other ground handling service providers in bole international airport with wider scope including passenger aircraft and terminal operations .

REFERENCES

- Fitouri-Trabelsi, S., Mora-Camino, F., Alberto Nunes-Cosenz, C. & Weigang, L., 2015. Integrated Decision Making for Ground Handling. *Global Journal of Science Frontier Research : F*, Volume 1, p. 18.
- HAN, C.-h., 2018. Assessing the Impacts of Port Supply Chain Integration on Port Performance. *The Asian Journal of Shipping and Logistics*, Volume 2, p. 7.
- Jindrich, d. & Stoji, S., 2019. *Model of Ground Handling Processes and Establishing Safety Mechanisms*. Prague, Czech Republic: Czech Technical University in Prague, Faculty of Transportation Sciences.
- Kolukisa, A., 2012. *Evaluating Aircraft Turnaround Process in the Framework of Airport Design*. Porto : Doctor of Philosophy of Faculdade de Engenharia da Universidade do Porto.
- AlonsoTabares, D. & -Camino, F., 2017. Aircraft groundhandling:Analysisforautomation. *17th AIAA AviationTechnology,Integration , and Operations Conference*,, p. 17.
- Berhane, T., 2019. *The Role of Information Communication Technology in SCI and SCP*, Addis Abeba : AAU.
- Bete Georgise, F., 2014. Supply Chain Integration in the Manufacturing Firms in Developing Country: An Ethiopian Case Study. *Journal of Industrial Engineering*, 2014, Article ID 251982,(1), p. 13.
- BIZUAYEN , R., 2019. *The Role of Logistics information system on logistics performance , case study* , addis abeba: s.n.
- Bowersox, 2002. *Supply chain Mangment*. 3rd ed. Newyork: McGraw-Hill~lwin, an imprint of The McGraw-Hill Companies, Inc..
- C. Marinagi, 2015. *Information Quality and Supply Chain Performance: The Mediating*. Greece, Science Direct.
- Clemons, E & Reddi, S, 1993. The impact of information technolgy on the organization of economy. *Journal of Management Information System*, pp. 9-35.
- El Asri, H., 2018. *Aircraft Ground Handling Operations: A Literary Review*, Oman: German University of technology in Oman;.
- Eric Dossou, P., June 2017. *Modeling Supply Chain Performance*. France , Science Direct .
- Fitouri-Trabelsi, 2014. *An Operational Approach for Ground Handling Management at Airports with Imperfect Information*. Valladolid, Spain, 19th International Conference on Industrial Engineering and Operations Management, pp. 455-475.
- Fitouri-Trabelsi, S., Alberto Nunes Cosenza, C. & Mora-Camino, F., 2013. *Ground Handling Management at Airports with Fuzzy Information*. Fortaleza, Brazil, 6th IFAC Conference on Management and Control of Production and Logistics.

- Frank , T. & Fruth, M., 2017. OPERATIONS, INFORMATION & TECHNOLOGY. *Digitization in maritime logistics — What is there and what is missing ?*, 23 November, pp. 1-40.
- Gang, L. & Hongjiao , Y., 2009. The Impact of IT implementation on supply chain integration and performance. *Int. J. Production Economics* 120 , p. 125–138.
- Genzorova, 2019. How digital transformation can influence bussiness model, case study for transport industry. *Transportation Research Procedia* 40 (2019) 1053–1058, p. 6.
- Kayikci, Y., 2018. *Sustainability impact of digitization in logistics*. Istanbul, Turkey, Turkish-German University, Department for Industrial Engineering, Sahinkaya Cad.
- Kovynyov, I. & Mikut, R., 2018. Digital transformation in airport ground operation. *Digital transformation in airport ground operation*, p. 25.
- Kumar, V., 2017. *The Impact of Supply Chain Integration on Performance: Evidence*. Modena, Italy , Science Direct .
- Lee, H. L., & Billington, C, 1992. Managing supply chain inventory , pitfall and opportunities. *Salon management review* , pp. 65-73.
- Marcus Wolf, Arlett Semm & Christian Erfurth, 2018. Digital Transformation in Companies – Challenges and success factors. *Department Industrial Engineering, University of Applied Sciences Jena*, pp. 173-193.
- Marks, A., Rietsema, K. & AL-Ali, M., 2015. Airport Information Systems—Landside. *Intelligent Information Management*, p. 9.
- Marta, R., Ana, M. & Vanessa, 2018. *The Challenges of Digital Transformation for fast-fashion brand*. Spain, Springer International Publishing AG, pp. 95-103.
- Mergel, I., 2019. Defining digital transformation: Results from expert interviews. *Government Information Quarterly*, Volume 3, p. 16.
- MICHAEL, C., N. & D, A., 2001. The Impact of Organizational Structure on Supply chain integration. In: *The Impact of Organizational Structure on Supply chain integration*. Newyork: Wiley Online Library, pp. 883-911.
- Mohan Reddy, J., 2018. *A review on supply chain performance measurement systems*. India , Science Direct .
- Narasimhan, R., 2001. INFORMATION SYSTEM UTILIZATION STRATEGY. *JOURNAL OF BUSINESS LOGISTICS*, pp. 51-75.
- Patnayakun, R., 2002. *TOWARDS A THEORETICAL FRAMEWORK OF DIGITAL SUPPLY CHAIN INTEGRATION*. Philadelphia, Research Gate .
- Patricia M, S., Soumen , G. & Nagesh , M., 2008. Achieving supply chain agility through IT integration and flexibility. *Int. J. Production Economics*, pp. 288-297.

Ram , N., 2001. INFORMATION SYSTEM UTILIZATION STRATEGY. *JOURNAL OF BUSINESS LOGISTICS*, pp. VOI,22 No. 2.

Ram Narasimhan, R., 2001. INFORMATION SYSTEM UTILIZATION STRATEGY. *JOURNAL OF BUSINESS LOGISTICS*, p. 25.

Reza , S., 2019. The effect of IT integration on improving agilityintegration and performance of supply chain. *nt. J. Advanced Operations Managemen*, p. 16.

Rosenzweig, E., Roth, A. & Dean, J, 2003. The influence of an integration strategy on competitive capabilities and business performance:. *Journal of Operations Management*, pp. 437-456.

Sahu, N., Deng, H. & Mollah, A., 2018. *Investigating The Critical Success Factors Of Digital Transformation For Improving Customer Customer*. Melbourne, Australia , Association for Information Systems, International Conference on Information Resources.

Shapiro, J. F., 2001. Modeling and IT Perspectives on Supply Chain Integration. *Information Systems Frontiers* , pp. 455-464.

Skye Gilbert, S., 2017. Assessing stability and performance of a digitally enabled supply chain:. *etrospective of a pilot in Uttar Pradesh, India*, Volume 35, p. 6.

TaherdoostP, H., 2017. *A review of technology acceptance and adoption models and theories*. Tirgu-Mures, Romania, Science direct .

Vagheeswer, . S., 2013. *Authomated ground handling of aircraft*. Pittsburgh, US, Patent No. US 8,694, 238 B2.

Vikas , K., 2021. *The Impact of Supply Chain Integration on Performance: Evidence*. Modena, Italy , Procedia Manufacturing, pp. 814-821.

World Economic Forum, 2017. *Digital Transformation Intiatives , Aviation , travel , tourism Industry*. CH-1223 Cologny/Geneva: White Paper .

Yafet, M., 2018. *The Role of Information Technology in Logistics and Supply Chain Managment performance* , Addis Abeba : AAU.

Appendix

ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF COMMERCE
DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT
POST GRADUATE PROGRAM

Dear Participant,

I am a postgraduate student at Addis Ababa University School of Commerce and I am conducting a study on “the role of digitization of aircraft ground handling on supply chain integration of Ethiopian cargo & logistics service”. The purpose of the questionnaire is to collect primary data to conduct the study for the partial fulfillment of Master of Arts in Logistics and Supply Chain Management. This is purely for academic purpose and the information you provide will be kept strictly confidential. Hence, I kindly request you to fill the questionnaire genuinely. Thanks in advance for your cooperation.

General Instruction

- please do not write your name or address on the questionnaire.
- please put a tick mark in the appropriate box of your answer
- Contact address: if you have any question please contact through the following address

Telephone: 0911 99 696 60
Email : Dawittd@gmail.com

Questionnaire

Please give answers in the spaces provided and tick in the box that matches your response to the questions where applicable.

Part I: Demographic Profile of the respondent

1. Gender. i. Female ii. Male
2. Age
 - i. Below 25 Years
 - ii. 26-35 Years
 - iii. 36-45 Years
 - IV. Above 45 Years
3. Marital status
 - i. Single
 - ii. Married
 - iii. Divorced
 - iv. Separated
4. What is your level of education?
 - i. Grade 1 to 12
 - ii. Certificate holder
 - iii. Diploma holder
 - iv. Bachelor's degree holder
 - v. Master's degree and above
5. How long have you been working in this Company?
 - i. Less than 5 year's
 - ii. 5 to 10 years
 - iii. 11 to 15 years
 - IV. More than 15 years
6. In which process, department or section are you working at ECLS, if you are external stakeholder, please tick supplier?
 - I. Business Transformation Expert
 - II. Loading/unloading handling coordinator
 - III. Aircraft Line maintenance
 - IV. Supplier (If yes) Function _____
 - V. Customer (If Yes) Organization type _____
7. Role in the existing system
 - I. System User
 - II. System developer
 - III. Operational System support

Part II: Aircraft Ground handling (AGH) Digitization Practice

Please rate your level of agreement using the following 5 point scales given for your responses where “1”=Strongly Disagree; “2”=Disagree; “3” =Neutral; “4”=Agree; “5”=Strongly Agree)

Digitalization in Aircraft Ground handling (AGH)	1	2	3	4	5
Aircraft marshaling while parking and dispatching is supported by automatic guidance system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
There is a common information system to coordinate the aircraft serving activities like fueling ,catering and cleaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aircraft routine maintenance planning and preparation is assisted with information technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flight data preparation is being done by information system application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cargo loading and unloading guided by automated information system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GSE & Staff allocation and scheduling has its own information system application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part III: Aircraft Ground handling (AGH) Digitization Challenges

Follow the instructions given for your responses (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)

A. Internal Challenges affecting Digitalization

Employee’s skill & technology acceptance	1	2	3	4	5
System user’s lack of technical and IT knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
System user’s fear for technology acceptance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inadequate training on system utilization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of system user’s commitment on IT knowledge development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
System developer’s limitation to business requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
System developer’s understanding of operational issues is low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
System developer’s knowledge level on AGH business process is low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of Top management Commitment technology dependability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Company’s top management commitment for AGH digitization initiatives is limited	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Company’s top management’s underestimates the economic benefit of AGH digitization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. External Challenges affecting Digitalization

	1	2	3	4	5
Digitization is affected by economic factors					
AGH digitization in the value chain is costly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AGH digitization is impacted by lack of enough budget	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AGH digitization will incur huge maintenance and monitoring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization is affected by legal factors					
AGH digitization is affected by the working legal framework of stakeholders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AGH digitization. is affected by the legal system of nations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AGH digitization is affected by the capability of legal expertise in understanding Information systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization is affected by Technology					
Lack of modern ICT infrastructure(physical & virtual) in the country affects the AGH digitization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of sustainable power affects the AGH digitization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Poor deployment and implementation of individual systems affects the AGH digitization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part III: Role of AGH Digitization on Supply Chain Integration

Follow the instructions given for your responses (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)

	1	2	3	4	5
Customer Integration					
Digitization of the AGH increase company's Responsiveness to customer integration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increased the flexibility customer integration practices,	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increased the company's reliability to customer integration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH decreased the cost of customer integration practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internal Integration					
Digitization of the AGH increase company's Responsiveness to its internal integration practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increases company's reliability information sharing platform	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increased the flexibility of cross functional planning between departments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Digitization of the AGH decreased the cost of common compliance & standardization procedures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supplier Integration	1	2	3	4	5
Digitization of the AGH increase company's Responsiveness to its supplier integration practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increase company's reliability to its supplier integration practice which enables joint planning of services with suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increased company's flexibility of information sharing with suppliers instantly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH decreases the cost of information uncertainty and transaction frequency during communication with suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Measurement Integration	1	2	3	4	5
Digitization of the AGH increase company's Responsiveness to its measurement integration practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH reduce the company's cost to its measurement integration practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increase company's flexibility to indicate financial impact assessment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increase company's reliability in enabling easy benchmarking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information Integration	1	2	3	4	5
Digitization of the AGH increase company's responsiveness in sharing of real time & accurate information flow as its information integration practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH provides strong connectivity among company's individual functional systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increase company's reliability in enabling centralized information sharing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH helps to reduce system interfacing costs across the value chain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relationship Integration	1	2	3	4	5
Digitization of the AGH increase company's responsiveness in creating effective communication platform with stakeholders and/or supply chain partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increase company's reliability of sharing of data among stakeholders and/or supply chain partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH increase company's flexibility in creating functional visibility and transparency among stakeholders and/or supply chain partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH decrease company's cost for resource coordination among stakeholders and/or supply chain partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digitization of the AGH assists the company to resolve performances conflicts with stakeholders and/or supply chain partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>