

SHIPS & ROSES: A REVELATORY CASE STUDY OF AFFORDANCES IN INTERNATIONAL TRADE

Completed Research Paper

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Abstract

International trade involves crossing several organizational boundaries. This revelatory case study follows fresh cut roses' journey from the growers in Kenya to the retail distribution in Holland and shows relatively high barriers related to the associated activities, information and documents, etc. Our empirical findings reveal the serious limitation that existing inter-organizational system (IOS) only facilitates actor-to-actor information forwarding in a communication chain of peer-to-peer communication along the supply chain and has no provision for persistent and simultaneous exchange of information between multiple actors. To address this limitation, we conducted a comparative analysis of affordances of the existing vs. future inter-organizational information systems with a focus on sharing critical information. Our extended analysis shows that modern IT features supporting affordances could be useful for the actors' collaboration in the trade lane of the roses. We discuss some of the benefits of our proposed approach (e.g. lower transaction cost and real time information) but also raise some concerns (e.g. about trust and governance) which calls for further research.

Keywords: Inter-organizational Systems, International trade, Activity Framework Theory, Affordances, Information Infrastructure, Supply Chain Analysis.

1 Introduction

International trade involves crossing organizational boundaries. For example, when shipping roses from Kenya to European Union, multiple organizations are required to transport the roses from the growers in Africa to the retail distributors and consumers in Europe. For general international traded cargo average retail cost breakdown is as follows: 1/3 product cost + 1/3 retail distribution cost + 1/3 international trade cost. In this paper, we focus on the international trade cost which is broken down into 1/9 physical transportation cost with remaining 2/9 of the cost accrued from barriers that exist when crossing national borders and organizational boundaries (Anderson & Van Wincoop, 2004). Compared to general cargo, the international trade costs are even higher for roses because they need to be refrigerated during the transport and additional phytosanitary inspections are required. Therefore, improvements addressing barriers related to crossing the organizational boundaries can have significant impact with regard to international trade. Importantly, reduction of the cost of the barriers is estimated to have significant impact on not only international trade volume but also GDP. For example, an improvement to half-way of regional best practice is estimated to have similar impact as removing all tariffs resulting in increased trade volume by 15% and GDP by 5% (WEF, 2013). Such improve-

ments are important for the economies of the countries involved in international trade (e.g. Kenya). In this regard, this paper investigates how modern IT could help support efficient and effective administration related to crossing organizational barriers in international trade and thereby lead to reduced trade costs, increased trade volumes, and ultimately economic growth.

1.1 Research Question

Situated in the domain of international trade as discussed above, this paper addresses the following research question: *What are the administrative issues preventing efficient international trade of flowers, and how can those issues be addressed by utilizing modern information technology?*

The remainder of the paper is organized as follows. First, the theoretical framework is presented and discussed. Second, methodological considerations are discussed and case study data collection events and methods are listed. Third, results from empirical analysis are reported. Fourth and last, empirical findings are discussed, implications for research are generated and future work is outlined.

2 Theoretical framework

The theoretical framework for the research project draws upon concepts from four different theoretical streams: (a) infrastructures theory for supply chain analysis, (b) activity theory for domain analysis, (c) inter-organizational system theories and information infrastructures theory for organizational boundary crossing analysis, and finally (d) affordances from ecological psychology and human-computer interaction for IT-artefact analysis. We found the need to utilize all four theoretical lenses to understand the different issues in and aspects of the phenomena: supply chain for *international trade of fresh cut roses across multiple organizational boundaries and borders from Kenya to EU involving multiple IT systems*.

Organizational boundaries and inter-organizational conflict has been recognized and theorized for years. Recently, the topic of electronic cross-organizational and cross-border collaboration has gained renewed interest (Aldrich, 1971; Evan, 1965; Romano, Pick, & Roztocki, 2010). Analyzing the organizational boundaries and boundary objects alone from micro-agent level will prevent a holistic understanding of the phenomena at the meso level of organizations and macro structural level. Similarly, employing exclusively the meso and macro levels will not reveal the motivations and behaviours of actors, logistics details, and IT affordances at the micro level. As the proverb goes, we needed to know not only about the individual trees in the forest but also have an overview of the forest. An additional reason for including the theory about information infrastructure and affordances within Human Computer Interaction (HCI) is that they represent two elements of modern IT in form of the internet and social web which might offer potential solutions to improving the international trade. We present and briefly discuss the four theoretical lenses below.

2.1 Supply Chain Infrastructure

Infrastructure is basic physical (and organizational) structures needed for facilitation and operation of a society and necessary for an economy to function (Sheffrin, 2003). The term typically refers to the technical structures that support a society such as roads, bridges, water supply, sewers, electrical grids, telecommunications and so forth. It can be defined as "the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions" (Fulmer, 2009). Infrastructures are characterized by nodes and means of connection as basis for activities, and that they are constantly evolving. The two key issues for the international trader of fresh products such as cut roses are the quality of the product and the international trade costs. The quality of cut flowers is strongly related to the lead time for getting them from the grower to the consumer (Christopher, 2012; De Treville, Shapiro, & Hameri, 2004; Stewart, 1995) and integrity of the cold supply chain. Our analysis starts with following the roses in the supply chain utilizing the established physical infrastructure with nodes in a net of routes (Christopher, 2012; Mangan, Lalwani, & Butcher,

2008). The supply chain analysis does focus on the physical world in order to address the involved actors (e.g., the exporter) who are geographically localized in their national communities and are governed by their national rules. Further, the actors use local technologies and equipment when handling the goods, related documents and information.

2.2 Activity Theory Framework

Activity Theory Framework (ATF) helps analyze the various supply chain infrastructure elements mentioned above from domain-specific systemic perspective. ATF provides a conceptual vocabulary as well as theoretical mechanisms that are relevant and useful for the description of the part of the international trade that takes place in the individual geographical area (e.g. Kenya for the export). Activity theory in general and Cultural Historical Activity Theory (Chatterjee, 2010) in particular have their origins in the Soviet Psychology of Vygotsky, Luria and colleagues (Roth & Lee, 2007; Vygotsky, 1930/1980, 1962). Activity theory has been applied in multiple academic domains such as developmental psychology (Wertsch, 1985), educational psychology (Jonassen & Rohrer-Murphy, 1999), learning sciences (James G Greeno, 1998), human-computer interaction (Kaptelinin, 2006; Nardi, 1998), information systems (Mursu, Luukkonen, Toivanen, & Korpela, 2007) and international trade (Jensen, Bjørn-Andersen, & Vatrapu, 2014). Instead of the standard ATF term of subject for human participants, we employ the term actor as it better emphasizes the actions contributing to completion of the activity. For analysis of empirical data collected (methodology section forthcoming), we follow Activity Theory Framework's dimensions for an activity: *actor*, *object*, *community*, *tool*, *rules*, *division of labor* and the *outcome*. An activity comprises of actions which are in turn constituted by operations. Further an activity is driven by a motive, each action has a goal and there are conditions for the operations (Kuutti, 1996). In our analysis, an activity can include actions of several actors each with their own motive but an action is performed by only one actor. Regarding the operations constituting an action of an actor, we have limited our description to include only the operation(s) in an action that other actions depend on (e.g. an authority update the status information to "permission to remove" the container from customs area which is relevant for the actor going to pick up the container).

2.3 Inter-Organizational System

Extant literature on the utilization of IT for collaboration across organizational boundaries and national borders is primarily focused on IOS (Kaniadakis & Constantinides, 2014). The extant literature on IOS employs more than 25 theories (Madlberger & Roztock, 2008) and no single theory stands out as predominant. The majority of research regarding IOS is focused on EDI (Reimers, Johnston, & Klein, 2004), and a majority of the described IOS are successfully utilizing EDI (Robey, Im, & Wareham, 2008). For international trade, the benefits of facilitating IOS based on EDI is well documented (J. King & B. R. Konsynski, 1990; King, 2013; J. L. King & B. R. Konsynski, 1990) and it has also been pointed out that the cost of change are relatively high (Henningsson & Bjørn-Andersen, 2009). Recent research projects have revealed the potential benefits for actors involved in international trade by utilizing IOS based on EDI messages for collaboration across organizational boundaries, for example ITAIDE project (Tan, 2010), Contain project¹, Integrity project², Cassandra project³. An information infrastructure is "*a shared, open (and unbounded), heterogeneous, and evolving socio-technical system consisting of a set of IT capabilities and their users, operations, and design communities*"(Hanseth & Lyytinen, 2010). Based on our literature review, we observe that the use of e-mail does not seem to have been considered a means of communication for IOS. In contrast, for international trade, the do-

¹ <http://www.containproject.eu/>

² <http://www.integrity-supplychain.eu/>

³ <http://www.cassandra-project.eu/downloads/>

main of this case study, our empirical data analysis (Results section forthcoming) reveals e-mails as the dominating mean of communication in practices.

2.4 Affordances

Having conceptualized the phenomena (“international trade of fresh cut roses from Kenya to EU”) from the supply-chain infrastructures, activity systems and IOS perspectives, our theoretical attention is now focused on conceptualizing and understanding the socio-technical interactions in terms of how the IT affordances are perceived and appropriated by actors. Based on foundational research in ecological psychology (Chemero, 2003; Gibson, 1979; J. G. Greeno, 1994; Sanders, 1997; Stoffregen, 2000; Turvey, 1992) and the enactive approach in the philosophy of mind (Garfinkel, 1967; Noë, 2004; Schütz, 1967), Vatrapu (2010) defines affordances as “*meaning-making opportunities and action-taking possibilities in an actor-environment system that are relative to actor competencies and system capabilities*”. This definition of affordances applies the relational ontology of affordances in ecological psychology to information systems and allows us to conceptualize and analyze meanings and actions made possible by the IT-artefacts both at system design-time and the real-time of actual use by actors involved in international trade. Here, our theoretical focus is in the Human Computer Interaction (HCI) subfield within the Information Systems discipline (Zhang & Li, 2004). The “Gibsonian” affordance theory suggests that successfully conveying the possibilities for meaningful action offered by a technology to the user should be a top priority in the design of interactive systems. The concept of affordances as action possibilities within modern IT systems has been employed in IS recently and we draw from this growing body of IS literature (Davern, Shaft, & Te'eni, 2012; Pozzi, Pigni, & Vitari, 2014; Treem & Leonardi, 2012) and extend the notion by including meaning-making opportunities based on Vatrapu (2010). In summary, the theoretical framework of supply-chain infrastructure, inter-organizational system, activity theory framework and affordances allow us to conceptualize, describe, understand, and analyze the different micro, meso, and macro levels of the phenomena of this case study: international trade of fresh cut roses from Kenya to EU. We present methodological considerations and data collection events and methods next.

3 Methodology

The unit of study is the international shipment (of fresh cut flowers) with related documents and information across multiple organizational boundaries and national borders. We employ the method of revelatory case study to investigate the international trade of flowers to Europe to address the research question. The case study method is especially relevant to our research problem since in international trade there are many more variables of interest than data points and therefore the results of the research relies on multiple sources of evidence with data convergence. A case study investigates a contemporary phenomenon in depth and within its real-life context (Yin, 2009). A revelatory case study (Sarker, Sarker, Sahaym, & Bjørn-Andersen, 2012) can potentially help to explain presumed phenomena in real-life interventions that are too complex for the survey or experimental research methods. We regard our case study as a revelatory case study since we as researchers have the “opportunity to observe and analyze a phenomenon previously inaccessible to social science inquiry” (Yin, 2014). We acknowledge that data collection methods for studying IOS involve a dilemma between authentic access to practices and the ability to thematize knowledge of practices (Reimers et al., 2013). Further, we recognize the difficulties studying IOS especially across borders which involves both private and public organizations (Reimers, Johnston, & Klein, 2010a, 2012), and we are inspired by a framework which views IOS as constellations of aligned practices (Reimers, Johnston, & Klein, 2010b). Due to the complexity of international trade, we have selected to focus only on the supply chain (and not the financial aspects) for a specific trade lane for roses from East Africa to Europe. In our case we have access to multiple organizations involved in the international trade across the private and public sectors. The data for this paper is collected over a period of 6 months by interviewing key actors in the organizations, visiting field sites, observing shipments of roses, conducting a set of focus group inter-

views and meetings in close collaboration with a key insider at the trader organization. Table 1 presents an overview of the empirical data collection.

Date and location	Event	Participants	Focus
2014-06-03 Delft, Holland	Meeting / presentations	Traders, authorities and researchers	Introduction to traders business
2014-06-04 Naaldwijk, Holland	Site visit and meeting	Traders and researchers	Follow the logistic flow
2014-07-08 Nairobi and Mombasa, Kenya Salalah, Oman; Antwerp, Belgium Aalsmeer, Holland	Shipment from Kenya to Holland	Roses in containers	Collect communication, information and documents plus container monitoring data
2014-09-09 Sosterberg, Holland	Meeting	Traders, authorities and researchers	Understand actors involved
2014-11-17 Delft, Holland	Meeting	Traders, authorities and researchers	Understand authorities procedures
2014-11-18 Aalsmeer, Holland	Site visit	Traders, authorities and researchers	Follow inspection by authorities
2014-11-18 Aalsmeer, Holland	Meeting	Traders, authorities and researchers	Understand objectives of key actors
2014-11-19 Aalsmeer, Holland	Meeting	Trader informant	Analysis of communication by trader
2014-10-12 – 2014-12-20 Weekly virtual meeting	Validation	Trader informant	Validation of findings

Table 1. Overview of Empirical Data Collection

4 Analysis

Our analysis starts by following the roses in the supply chain from the growers' fields to the retail distribution, adds the actors, documents needed, information systems involved, and the IOS communication to describe what's going on when a trader ships roses from Kenya to EU.

4.1 Supply Chain and Infrastructure Analysis

The supply chain for the roses from the growers in Africa to the retail stores in Europe is relatively straight forward. The roses are cut at the grower's farm in the high land of Kenya where they also are quality accessed, packed and brought to the traders' facility in Nairobi and after consolidation loaded into a refrigerated container. The container is transported approximately 500 kilometers by truck to Mombasa, the nearest port served by container vessels, where it awaits the booked vessel. In the terminal at the port, the container is loaded by crane on the vessel bound on its journey for Europe. The container is transshipped to another vessel in Salalah, Oman before it enters Europe in the port of Antwerp, Belgium. The container might be inspected and / or scanned before it's cleared by the authorities to entering EU. It's possible to apply for a postponement of the customs clearance and the inspection by the phytosanitary authorities to another customs location in this case at the freight forwarders location at the flower auction and distribution center in Alsmeer in Holland. The container goes by truck to the flower auctions in Aalsmeer, Holland where the roses are unloaded from the container to special designed handling units and trolleys. The flowers then await custom and phytosanitary inspection and clearance. After clearance the flowers are moved to a special treatment location inside the FloraHolland premises to be processed which takes about 1-2 days. Then they are ready to be sold at the flower auction. The buyer(s) of the flowers are now in charge of the onward distribution to the retail primarily by truck.

The supply chain' nodes and legs in the transport is a relatively simple chain with nodes at the exporters consolidation centre in Nairobi, the custom's territory at the terminal in the port of Mombasa, the custom's territory for transshipments in the port of Salalah in Oman, the Belgian custom's territory in the port of Antwerp, the bonded warehouse of the freight forwarder at the trader's auction and distribution centre in Aalsmeer in Holland; and with the transport legs in between the nodes by trucks on the roads and by container vessels servicing the routes of international container shipping plus special equipment for internal transport of containers at the ports (e.g. cranes for transferring from quay to the container vessels).

The transport of the roses utilizes the established infrastructure for containerized cargo combining several mode of transportation. The infrastructure is based on the standardization of containers which enables relatively easy shift in mode of transport (Levinson, 2010), e.g. from road to sea. Besides the container the main elements in the infrastructure are roads, trucks, ports with container terminals, container vessels, and other special designed equipment (e.g. straddle carriers, container cranes and container scanners). For refrigerated containers, additional equipment and supplies as power and monitoring are needed to ensure integrity of the cold chain e.g. the temperature is kept at the right level during the transportation. The total lead time is approximately 34 days of which the roses are on the move two third of the time and the rest is spent standing still waiting for outcomes of administrative processes. Part of the waiting time is planned slack to allow for uncertainty of the next mode of transport and in the administration procedures. (The reliability of shipping is in average 73,1% according to survey from SeaIntel September 2014). For example, at least 24 hours prior to start of loading, the authorities in the EU have to be notified. Since the loading might take several days, it is required that the container is at the port of departure on Monday for the vessel scheduled to depart on Thursday from Mombasa, Kenya.

We find that for the majority of the journey (of the roses), none of the actors know exactly where the roses are. Instead they know only the planned and recorded actual time and date for certain events and hereof only a few are communicated to other actors. For example, the pickup of the stuffed container is planned and agreed with the trader and the freight forwarder only, the planned and actual load and discharge of the container with the roses is booked, recorded and publicly available but not communicated. Similarly, the entrance and exit of customs areas recorded by the terminal operator and communicated to the port community system is only accessible for paying members of the port community. We find that the actors have learned to live with the lack of information about the containers. The trader reports several occasions of no shows, delays and of unexpected arrival of containers. These kinds of events and the uncertainty due to the lack of insight (e.g. of the arrival date of the container with the roses) makes it difficult to plan the retail distribution, especially in connection with events and holidays with fixed dates e.g. Mother's day.

4.2 Analysis of Activity System and Organization Boundary Crossing

The Activity Theory Framework (ATF) provides a set of dimensions for the analysis of the systems. Especially, ATF is well-suited for analyzing a multiple system environment involving diverse organizations in different national settings. Table 2 below is the essence of the ATF analysis followed by short descriptions related to each dimension. The table columns are structured according to the supply chain events for the roses' journey as identified in §4.1 above.

Several of companies and organizations are involved in the international trade of the roses from Africa to Europe. The trader of the roses acts as the value captain of the supply chain. The trader uses a range of service providers for the transportation of the roses in the container(s). They engage with a shipping line for the deep sea ocean transport, freight forwarders for the land transport and other service agents are involved as well. The objectives for the trader are to *“reduce the number of inspections which generate unpredictable disruption of the flow in the supply chain and to reduce the administrative burden and associated cost”* (presentation at meeting in June 2014). Today the

transport of the roses is as air cargo to lower the lead time. The possibility to transport by sea will reduce the cost of the transport by half but also prolong the lead time significantly.

Main Supply Chain Activity Dimension	Growing East Africa	Export consolidation Nairobi, Africa	Land transport	Clearance for export Kenya	International Shipping	Clearance for import to European Union	Land transport	Import deconsolidation Europe	Retail Distribution
Actors Organizations and companies	Growers	Trader + Service provider	Service provider (freight forwarder)	Authorities + Freight forwarder	Terminal operator Shipping line	Authorities Clearance agent	Service providers	Trader	Retail / Consumer
Communities Associations Cooperatives	Cooperative of growers	Cooperative of growers	Alliances of national freight forwarders	East African Authorities World Custom Organization	Alliances of shipping lines	European Tax Authorities World Custom Organization	Alliances of national freight forwarders	Cooperative of growers	Alliances and Cooperative of European Flower importers
Objects Goods (roses) Documentation / Information	Packing list and pro forma invoice Fresh cut roses in carton boxes Invoice	Consolidated packing list Roses in refrigerated containers	Refrigerated containers (with roses) Import declaration	Export declaration Phytosanitary certificate Certificate of origin EUR1 Movement Certificate /Form A	Refrigerated containers (with roses) ENS with B/L	MRN / DNL based on ENS) Import declaration	Refrigerated containers (with roses) Import declaration	Roses in refrigerated containers with related documents and information	Roses in special transport units with product description
Tools / equipment including enterprise information systems	Farms for growing roses Enterprise system	Special designed packaging material Local Enterprise system	Local means of transports as trucks Legacy system	Local authorities information systems e.g. KenTrade for export declaration etc.	Cranes etc. container vessels, information system of terminal operators and shipping line	Local port community information systems, EU authorities information systems	Local means of transports as trucks Legacy system	Special designed transportation units Enterprise system	Local means of transports as trucks, system
Rules	National regulations	Exporting regulations in country of origin Kenya	International trade regulations, seafarer rules, etc.	Exporting regulations in country of origin	International trade regulations, seafarer rules, etc.	Import regulations in EU and the importing country e.g. Belgian	Law road transport of goods	Importing regulations in country of destination	Rules regarding consumers rights
Division of work Motivation	Growing	Trading packing	Transport by truck	Controlling and inspection	Transport, storage shipping	Controlling and inspection	Transport by truck	Trading and distribution	Transport by truck,

Table 2. *Activities for international trade of fresh cut roses's journey from Kenya to Europe with respect to selected actors, communities, objects, tools, rules, etc.*

As it is to be expected, our analysis reveals that multiple national borders and organizational boundaries are crossed on the roses' journey. The rules and regulations that apply are given by the national and regional authorities governing the nations which the roses pass on its journey. The roses are all the way owned by the growers until they are sold at the flower auction in Aalsmeer. The trader might delegate the responsible for coordination of the transport to one service provider covering sev-

eral legs of the transport. The growers trust the trader who hands over the consignment the container with the roses to a chain of service providers: first the freight forwarder, then to the terminal operator in the port of Mombasa, then to the shipping line who interim transfer it to the terminal operator (and authorities) in the transshipment port, and back again to the shipping line, and then to the terminal operator in the port of destination, where the third party logistic partner takes over after clearance by customs and utilizes two freight forwarders for respectively scanning and transport to Aalsmeer in the Netherlands in their bonded warehouse awaiting phytosanitary inspection. Then and only then, the consignment is finally given back to the trader who will redistribute the roses to the new owners after the auctioning and processing. In total, the consignment of the roses has crossed national borders **five** times and has been handled and thereby crossed the organizational boundaries of at least **eleven** actors and **seven** authorities. In total, more than **seventeen** actors in form of companies and organizations are involved in the transport of the roses. The overall responsible actor is the trader who on behalf of the growers pays tariffs and also pays for the transport and other services provided by the service providers. In summary, our activity system and organizational boundary crossing analysis reveals that the roses' journey utilizes a rather complex set of organizations for its journey.

The authorities, both in Kenya and in Holland, are required to inspect the roses and performing risk assessments wherefore they like to know the organizations involved and what's inside the container. The exporting authorities in Kenya need to fill an internationally agreed upon phytosanitary form and even so the importing authorities in EU need to inspect the imported flowers upon arrival to EU. Additionally, the authorities demand certain documentation before the transport can be allowed, which is described more in detail in the following section. Both the private companies and the public organizations involved in the international trade of flowers are members of one or more communities in terms of the activity system. The traders in this case belong to a community in form of a cooperative of growers. Otherwise communities in terms of industry associations, collectives, and cooperatives are not directly involved in the shipment of the roses but to some extent provide guidance and connections. The actors, communities, tools, equipment, rules and procedures are located locally in their country except for the international shipping line and only the container (with roses) and related documents are exchanged between the involved organizations.

Having analyzed the global supply chain infrastructure in §2.1 and a decomposition of that into activity systems and boundary crossings (national and organizational) in §4.2 above, we turn our attention to the IT aspects of the phenomena by analyzing the inter-organizational systems and appropriation of affordances of IT-artefacts by individual actors in §4.3 and §4.4 respectively.

4.3 Inter-Organizational System (IOS) Analysis

To repeat, the physical activities related to the movement and transport of the roses in the international supply chain is described in §4.1 and §4.2 above. Findings so far show that each of the physical movements seems in itself to be with the planned speed and according to schedules. However, we find that it is the administrative procedures that result in delays and necessitate a built-in-slack in the supply chain. Therefore, we turned our analytical focus to the administrative procedures with respect to the inter-organizational systems and communications. This was done by analyzing the documentation and information exchanged between the organizations involved in the cut flowers' journey from Kenya to EU. The authorities require documentation both before allowing the export out of Kenya, before loading on a vessel if bound for EU and before the import to EU. Certain documents have to be approved before an action can be performed. For example, before entering the custom area of the port of Mombasa, the Kenyan custom need to clear the container and the content of roses for export, and at least 24 hours before departure of the container (with the roses) on the vessel in Mombasa an Entrance Summary Declaration (ENS) has to be filled to the authorities in EU. Otherwise, they can reject to allow the container' entrance to EU.

The content of the documents are primarily concerned with the goods (in our case the roses) but require the information to be formatted in a specified form. Besides these documents additional

documents are used between pair of actors in the supply chain. For instance, between the trader and the shipping line, seven types of documents are exchanged and two payments are transacted. For four of the seven types of documents mentioned above to be valid, it's required for them to be signed and stamped by authorized officers. As such, only the original of those documents are admitted as valid documents and requires a separate handling and are therefore sent by air courier from Kenya to Europe. On top of the required documents, additional information is required for the individual actor to be able to perform the operations involved. For example, the trader books the shipment with the shipping line and gets a confirmation of it. Another example is that the freight forwarder' need a special document to enter the port area in Mombasa and in the port of Antwerp similar information is required to be able to pick up the container. Generally, information is not shared with any of the other actors. Additional documents, see appendix, are involved in the shipment of roses: the actors with the shipping line handles besides the Bill of Lading the following documents e.g. booking, booking confirmation(s), contract, amendment, shipping instruction and invoice plus a number of e-mails.

The relevant documents mentioned above are stored by each actor in their own enterprise information systems. Generally, the enterprise information systems can only be accessed by employees of the actor' organization and are not accessible by other actors. The total number of systems involved is more than **twenty**. This count does not include e-mail, fax or similar information systems. The authorities in both Kenya and Europe have each their set of information systems. The different authorities to a large extent have their dedicated systems. To some extent, some of the authorities' systems have been simplified to one user interface often referred to as a single window system. The documents are filed in at least **five** different systems of the authorities. The other actors also have various information systems which they utilize in connection with the shipment of the roses. Each of the service providers also utilize a range of enterprise information systems e.g. for operation, for customer relation and for accounting. For example, the shipper utilizes at least **three** enterprise information systems and the shipping line utilizes at least **five** enterprise information systems in connection with the shipment of the roses. Very few of the enterprise information systems are capable of communicating electronically with other information systems. For example, the ENS is communicated from the shipping line to the authorities information system Import Control System (ICS) via EDI communication and in return is received a Movement Reference Number (MRN) and possible a "Do Not Load" (DNL) message.

Similarly, the collaboration between the terminal operator at the ports and the shipping line, and the freight forwarder and the shipping line involves some EDI communication of some standard information but they also use additional communication channels. The communication is mainly done via e-mail and ordinary mail/courier for the original versions of the documents plus telephone for ad-hoc issues. The trader has a team of dedicated people for the shipment of roses and their archive folder contains approximately hundred e-mails for the shipment analyzed initially and hereof one third had attachments. Our analysis reveals that the IOS used is peer-to-peer based communication and for some information it turns out to be a chain of peer-to-peer communication where the information is re-typed or copy+pasted from or into the actor' enterprise information system. Interestingly, the operations employees at the trader confronted with those results commented: "*From my view point then it's just part of my daily tasks to answer the incoming e-mails in relation to the shipments by processing it and forward or reply to the e-mail. I never thought about this as a chain of communication.*"

The IOS facilitates information forwarding from actor to actor in a communication chain of peer-to-peer communication along the supply chain. It's expected that the main reason for the use of peer-to-peer communication is historical and that the available and possible means of communication have been adopted instead of domain-specific design of IOS. Although the Internet had been adopted for communication recently it is only as a substitute for the older forms of peer-to-peer communication (e.g. e-mail has to some extent replaced fax and ordinary mail/courier).

Our analysis reveals that the individual actor has one or more enterprise information systems for handling needed documentation/information. Besides communication by e-mail and EDI, the actors ad-

ditionally use phone, text message, fax and other channels. This results in a range of fragmented and disconnected information infrastructures which is inefficient compared to having one common, persistent and shared information infrastructure and one communication channel for the IOS. Affordance analysis discussed next outlines the features of the current IOS (with the problem discovery of peer-to-peer communication chain) and specify the features of a future information infrastructure (with the solution proposal for a shared information provision and single communication channel).

4.4 Affordance Analysis

Each of the actors involved in the transport of the roses have their own motivation(s) and perform their own action(s). The growers want to grow and sell their roses preferable to export which is a growth potential for their business. The trader wants to earn profit by offering roses off the local season at a reasonable price and they would like to minimize their risk (e.g. lowering of the quality of the roses due to long lead times or braking the cold chain). The freight forwarder and the shipping line earn revenues from moving goods primarily in containers and related services. The authorities ensure that the law and procedures are followed, collect tariffs, and minimize security risk. The individual actor performing a particular activity's operations might have additional motives and goals. He or she is the one performing the operations which enables the movement of the roses in the supply chain and/or initiate other actions to be performed by other actors. These actors are the ones that can facilitate or disrupt the flow in the supply chain and the collaboration with other actors by communication or lack of it. Our analysis shows that these actors appropriate a few types of IT affordances namely send, file, update and approve / sign information/documents besides affordances associated with physical activities (deliver, process, transport and inspect) and payment activities. To provide an illustration, consider the IOS set up for the communication back and forth of the packing list used for Bill of Lading (B/L). The packing list for the container / shipment is a major source for filling in the above required documentation e.g. the B/L. The fact that the documents have to be filled prior to the closing of the container means that the source is the "planned" packing list which might be slightly different from what actually is packed in the container. This means that the quality of the information provided in the documents can vary and might deviate from the expectations of the authorities. The communication of the packing list is a chain of peer-to-peer communication: first, the trader / shipper requests the involved growers (in this case **eight**) for their packing list and pro forma invoices which the shipper consolidates to one packing list that is checked, approved and send forwarded to the local freight forwarder in Kenya, who then forwards the content to the international shipping line who utilize a mix of a local office in Kenya and a shared service center in India. In case of the packing list for the Bill of Lading then **five** instances of e-mail communication spread over several days were recorded with at least **five** different people from the shipping line communicating back and forth in the communication chain via the freight forwarder to the shipper and in some cases to the growers. After the stuffing of the container there was no communication of the actual packing list or any correction to the planned packing list. This is also the case for other documents. Primarily, the communication was done by e-mail resulting in hundreds of e-mails in various actors' e-mail boxes. Table 3 below outlines the current affordances of IOS vs. proposed future affordances of information infrastructure.

Inspired by affordances of modern IT applications like Facebook and Dropbox, we propose that an information infrastructure facilitating features as publish, share and follow / subscribe potentially could facilitate a new way of inter-organizational sharing of information and documentation. An initial proposal is sketched in Table 3 in the Appendix but there is a clear need for further research to evaluate the proposal. The proposed shared information infrastructure has nearly the same number of actions and operations and this need to be addressed in future research. Comparing the current IOS and the proposed shared information infrastructure, one of the main benefits is that the latest version of the published documents always will be available to all actors with the rights to view or update them, whereby much of the e-mail communication can be avoided. Additionally the relatively high cost of change of IOS based on EDI (Henningsson and Bjørn-Andersen 2009) is expected to be lowered since the number of interfaces are reduced. The trader is positively inclined towards testing our

proposed shared information infrastructure approach on future shipments of roses. The trader foresees reduced number of communications via e-mail and more efficient handling of the documents and information for shipments in a shared way instead of current reliance on key actors' e-mail accounts. Further, the trader also believes that our shared information infrastructure proposal can help in preventing mistakes such as missing original documents and provide warnings about outstanding payments especially in the case of absence of key actors. Further, the importing authorities, on a trial basis, have opened in their enterprise system the possibility to file a link as part of the filing whereby it's possible for the authorities to be directed via a link to the updated version of the documents (e.g. the real packing list). We acknowledge that the above solution is focused on the structured information and that there is also probably a need for unstructured information exchange which could be facilitated by affordances offered by social media alike Facebook.

5 Discussion and Conclusion

Our revelatory case study of international trade of cut roses from Kenya to EU shows that with regard to the supply chain, the physical infrastructure is quite efficient but for half of the time of the journey the roses are standing still due to built-in-slack times or delays caused by administrative procedures. We find that the cross border related administration is cumbersome and accordingly relatively costly. Informed by activity theory framework, we reveal that the roses' journey crosses **five** national borders and **seventeen** organizational boundaries, with distinct characteristics in form of dedicated primarily local / national actors, communities, tools / equipment, rules and procedures while only the roses (inside the container) with related documents travels across the borders and boundaries. The inter-organizational system (IOS) between the organizations are peer-to-peer communication along the supply chain primarily by e-mail and to a limited extent by EDI messages and a range of other communication channels which results in actors using multiple information infrastructures. One common shared information infrastructure based on modern IT fueled by the internet could potentially improve the current peer-to-peer IOS and offer real-time information to the involved actors similar to the efficient physical supply chain infrastructure.

Informed by Gibsonian affordance theory, we presented a design sketch for utilizing modern IT-affordances on one shared information infrastructure. This, we believe based on our case study results, can enable a more efficient IOS which does not follow the chain-linked organizations of the physical supply chain infrastructure but allow to skip the chain and go directly to the source of the documentation/information (e.g. authorities access to the real packing list from when the container was closed and sealed at consignment completion point). We foresee that the proposed shared information infrastructure can improve the flow in the supply chain, reduce delays, reduce the built-in slack, decrease the amount of administrative work (e.g. to forward, update and re-type information), and reduce the number of inspections based on improved data quality by providing access for the authorities to updated source data, which eventually will reduce the international trade cost and at the same time potentially increase security. In summary, below are the current aspects of and issues in international trade of cut roses from Kenya to EU of which some can be addressed by the proposed shared information infrastructure:

- a. The roses cross multiple borders and a complex set of opaque organizational boundaries
- b. The authorities inspections and scans are performed both by exporting and importing nations authorities They demand a range of documents to be filed prior to movement of goods
- c. The administrative burden is rather high and costly
- d. The lead time and the slack built into the international shipping is several days for each port
- e. Multiple enterprise information systems are utilized by individual actors and not shared
- f. The IOS facilitates peer to peer communication only, which means no one has visibility e.g. of the actual location of the container or updated version of documents / information available

The primary theoretical contribution of the paper is the combination of four separate theories to propose a solution addressing both the high level overview and the low level details needed for designing and building an IT solution. Administrative issues, among a few others, are the main barriers preventing improved efficiency for international trade of flowers. Our proposal to use features of modern information technology to address the above revealed issues for the journey of the fresh cut roses is an alternative to the currently IOS in use which primarily is based on e-mail and some EDI communication. As Robey et al (2008) points out, IOS procurement decisions have moved from organizational to market-driven whereby the cost is the major driver for the actors preference of IOS. We claim that IOS could move further by lowering the cost by utilizing the benefits provided by the modern IT' affordances. We acknowledge not only the benefits of our proposed approach (e.g. lower transaction cost and real time information) but also some concerns (e.g. about trust and governance).

The secondary theoretical contribution is the application of affordance lens and definition that is in line with the enactive view in the philosophy of mind in general and ecological psychology in particular (Vatrapu, 2010). The definition of affordances as both "action-taking possibilities" as well as "meaning-making opportunities" relative to actor competences and system capabilities not goes beyond the current understanding of affordances in IS as solely action potentials (Davern et al., 2012; Pozzi et al., 2014; Treem & Leonardi, 2012) but also highlights the importance of the skills and competences of the actors involved and the capabilities and features of the systems used. In the domain of international trade, as shown by our case study, the affordance analysis uncovers the multitude of actions, meanings, actor competencies and system capabilities and problems with their current configuration. The design solution then can target one or more of the four elements in that configuration. Further, our analytical combination of activity theory framework analysis and ecological affordance analysis can be situated within recent theoretical work that provided an activity theoretical interpretation of affordances (Kaptelinin & Nardi, 2012).

The proposed IT solution can be characterized as an information infrastructure but one different from the standard EDI message based inter-organizational systems. We note that Hanseth and Lyytinen (2010) do not separate the type of communication in the information infrastructure since they have both business/industry EDI based IOS and the internet as examples of information infrastructure. We find that the concept of communication makes a crucial difference between the EDI messages-based IOS and the proposed IT solution. Similar we find that the degree of standardization are very different for the information infrastructure for IOS by utilizing highly standardized EDI message and the "internet" for shipping information which like the web has very limited standardization required and none for the detailed information communicated. If the proposed IT solution is successful then it can become a new type of IOS and compared to the existing the EDI message-based IOS it's expected to be less costly or even free. Therefore, a successful demonstration of the proposed shipping information system is expected to be adapted rapidly by many of the organizations in the supply chain for international trade and might even be adapted by other business eco systems.

We acknowledge the limitations of our case study in analyzing just one shipment in one trade lane of fresh cut roses between two nations and only considering the supply chain (and not the related financial transactions). That said, our case study reveals results that we foresee to be applicable to international trade in general since it follows the same supply chain infrastructure and utilizes the same type of service providers and have to pass the same type of authorities (except for the phytosanitary inspections which do not apply for general cargo) which performs the same type of activities and affordances utilizing similar or even the same enterprise information systems and IOS. Therefore, it's reasonable to claim that international trade can potentially benefit from utilizing shared information infrastructures with modern IT-affordances. Of course, this claim needs to be further evaluated by future research. Our current and future work is focused on an evaluation of the potential use of features supporting modern IT affordances as a complementary means of communication compared to the existing IOS peer-to-peer email communication.

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Appendix A: Ten Most Important Required Documents

The ten most important required documents for the trade lane of fresh cut flowers from Kenya to European Union

1. Export declaration* filled by exporter which is the trader for the roses
2. Pro forma invoice filled by the growers and the trader (used by authorities to calculate tariffs)
3. Phytosanitary certificate for export⁴* filed by a service provider for the exporter / trader on behalf of the growers
4. Certificate of origin* filled by a service provider for the exporter / trader on behalf of the growers
5. EUR1 Movement Certificate filled by the service provider
6. Bill of Lading (B/L)* filled by service provider(s) for the exporter / trader on behalf of the growers
7. Entry Summary Declaration (ENS) filed by shipping line 24 hours prior loading at port
8. Arrival Notification (AN) filed by shipping line upon arrival at port of destination
9. Import declaration filled by a service provider for the importer / trader on behalf of the growers of the roses⁵
10. Plant Health Movement document filled by a service provider for the importer / trader on behalf of the growers

* Original(s) with stamps and signatures are required

Appendix B: Inter-Organizational Systems: Current v Future Schematics



Figure 1. Current Schematic of IOS Communication following Supply Chain of Fresh cut Roses

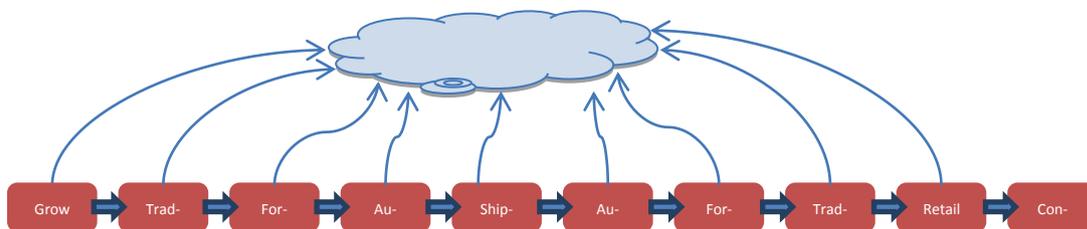


Figure 2. Future Schematic: IOS Communication utilizing Modern IT Affordances

⁴ According to EU regulation

http://ec.europa.eu/food/plant/plant_health_biosafety/trade_non_eu/docs/declarations_phyto_certificates_en.pdf

⁵ Fresh cut flowers from Kenya to Netherlands applies a import tariff of 8.5% (code 060311) <http://exporthelp.europa.eu/>

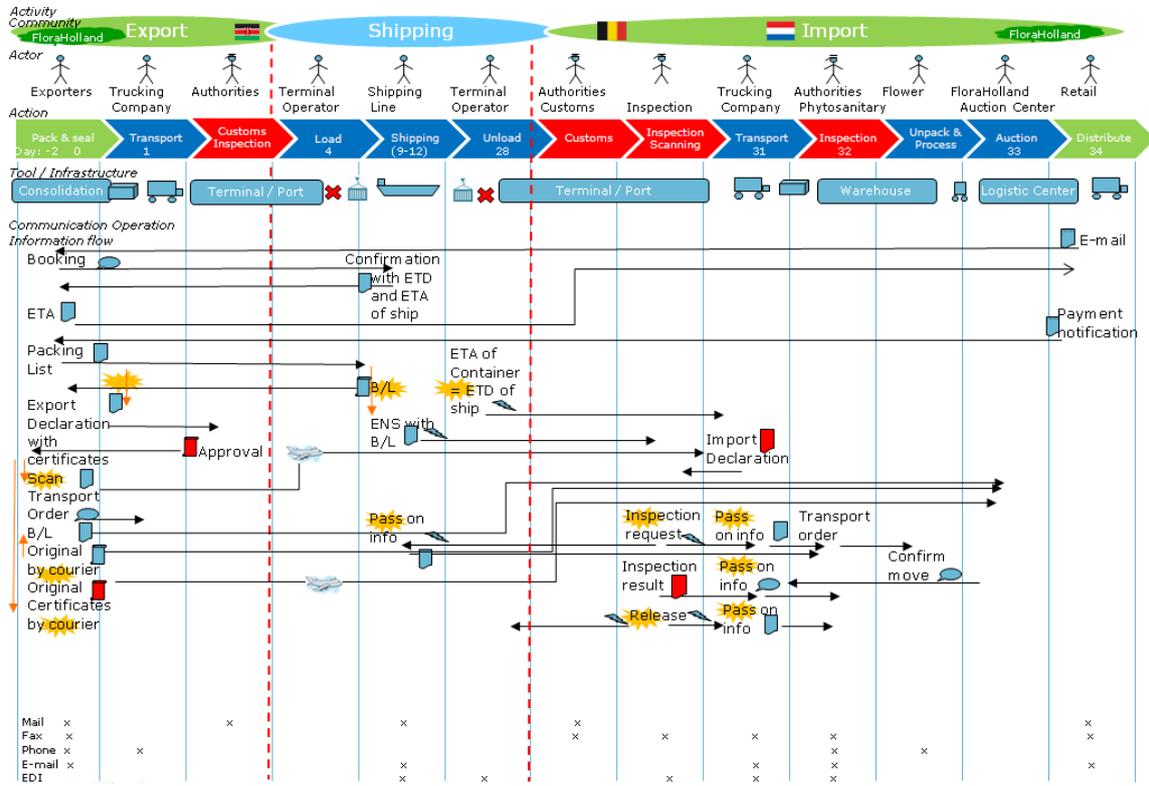
Appendix C: Affordances for Actors: Current v Future

Actors	Current IOS Affordances	Future Shared Information Infrastructure Affordances
Growers	2 <u>Send</u> confirmation of delivery with packing list and pro forma invoice 10 Deliver roses	2 <u>Publish</u> packing list and pro forma invoice 10 Deliver roses
Trader	1 <u>Send</u> request for deliveries 3 <u>Send</u> request for shipping 5 <u>Send</u> request for transport 7 <u>Send</u> packing list and pro forma invoice(s) 11 Process roses and seal container	1 <u>Send</u> request for deliveries 3 <u>Publish</u> request for shipping and container 5 <u>Publish</u> request for transport 7 <u>Publish</u> packing list and pro forma invoice(s) 11 Process roses
Service provider	6a <u>Send</u> confirmation of transport 8 <u>Send</u> forward etc. the packing list, pro forma invoice(s) and B/L 8a <u>File</u> export documents 8b <u>Send</u> request for inspection 12a Transport	6a <u>Publish</u> booking of transport 8a <u>Publish</u> export documents 8b <u>Publish</u> request for inspection 12a Transport
Authorities	12b Inspect roses and seal container 12c <u>Sign</u> documents for roses exported and seal 12d <u>Set</u> message for export to <u>allow entre customs area</u>	12c <u>Subscribe</u> and <u>Accept / digital sign</u> documents for roses exported 12d <u>Subscribe</u> and <u>Publish</u> permit message for export to <u>allow entre customs area</u>
Transporter, Terminal operator, Shipping lines	4 <u>Send</u> booking confirmation 9 <u>Send</u> back B/L etc. 10 <u>File</u> import documents e.g. ENS via EDI 13a Transport 13b “Hand over” when invoices are paid and presented with original B/L	10 <u>Publish</u> import documents e.g. ENS via EDI 13a Transport 13b “Hand over” when status is invoices paid and key provided
Authorities	14a Issue MRN / DNL message 14b Scan container 14c <u>Set</u> message “permission to remove” for import 14d Inspect roses 14e <u>Set</u> status “permission to move inside EU”	14a <u>Subscribe</u> ENS and <u>Publish</u> MRN / DNL message 14 b Scan container 14c <u>Publish</u> message “permission to remove” for import 14d Inspect roses 14e <u>Publish</u> “permission to move inside EU” message
Service provider	6b <u>Send</u> confirmation of transport etc. 8c <u>File</u> import and movement documents 8d <u>Send</u> notification to inspection 15 Transport	6b <u>Subscribe</u> and <u>Publish</u> <u>accept</u> booking of transport etc. 8c <u>Publish</u> import and movement documents 8d <u>Publish</u> notification to inspection 15 Transport
Trader	16 <u>Pay</u> service providers and tariffs 17 <u>Send</u> message to growers 18 Process roses 19 <u>Pay</u> growers	16 <u>Pay</u> service providers and tariffs 17 <u>Publish</u> message to growers 18 Process roses 19 <u>Pay</u> growers
Retail Consumer /	20 <u>Send</u> request for transport 21 Transport to stores / consumers	20 <u>Publish</u> request for transport 21 Transport to stores / consumers

Table 3. Affordance operations and types (underlined) with sequence numbering for international trade of fresh cut roses journey from Kenya to Europe. The physical ones are with bold text.

Appendix D: IOS: Current v Future Illustrations

Analysis of International Trade Lane of Roses from Kenya to European Union – As Is



Analysis of International Trade Lane of Roses from Kenya to European Union – To Be

