Research Article

Information Systems Innovation in the Humanitarian Sector

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Abstract

With the increase in humanitarian crises and consequent aid, there is greater demand for evidence of the effectiveness and accountability of aid. Information Systems (ISs) are critical for emergency response and humanitarian operations in fulfilling these demands, but also because the consequences of having or not having timely and accurate data are usually life and death. IS innovation in the context of the humanitarian sector highlights the need for context-based approaches to innovation. In this article, we explore the process of the improvement, development, and implementation of an international development organization's logistics and supply chain system in Chad. Actor-network theory provides the framework for making sense of this IS.

1. Background

In the past two decades, both the number of humanitarian emergencies and their tragic consequences have increased worldwide (Fritz Institute, 2005). The rising tide of civil conflict, war, and natural disasters in the world's poorest nations have led to a near explosion in disasters and emergencies, most especially in Africa (Relief Web, 2006). In response, the humanitarian aid community, which typically includes the United Nations, multi- and bilateral agencies, government bodies, nongovernmental organizations, private voluntary organizations, and other philanthropic foundations, has grown in size. However, there has been a lot of concern and criticism about the effectiveness of humanitarian agencies, as humanitarian relief and response budgets have continued to escalate. Donors demand value for money, and evidence-based interventions are expected to demonstrate their effectiveness and accountability (Lewis & Madon, 2004). Several organizations have embraced technological innovation as a way to improve performance and growth, as well as to enhance accountability, transparency, and visibility.

Effective information systems (ISs) are essential for all organizations anywhere in the world, regardless of size or purpose. Effective ISs (with accurate and timely information) are particularly critical for emergency response and humanitarian operations, as the consequences are usually life or death. These ISs are essential for the entire humanitarian process—from early warning and preparedness to emergency response and recovery activities. They facilitate timely and effective information flows for complex humanitarian activities, such as transport, logistics, supply chain management, resource mobilization, programming, monitoring, evaluation, and assessment. ISs also facilitate coordination, information creation, and sharing within and among humanitarian organizations and their

partners—important organizational attributes for effective and efficient responses in crises.

It is the contention of this article that many organizations, firms, and institutions have developed or adopted IS strategies and policies which assume universal imperatives and globally valid business objectives and expectations regarding the exploitation of the potential of the new technologies, all without systematic consideration of the organizational and broader context within which these innovations are embedded (Avgerou, 2001; Schware & Kimberley, 1995; Talero & Gaudette, 1995). This universalistic perspective assumes that IS innovation is driven by specific values of universal relevance and validity, and therefore presupposes that it is possible both to explain any IS phenomenon in terms of a set of general concepts, and to discover logical principles as the basis for an effective pattern of professional action and organizational behavior (Avgerou, Ciborra, & Land, 2004).

IS innovation in the context of the humanitarian sector is unique, complex, and not driven by the same globally valid objectives and imperatives as business firms in a free market context. Indeed, research on IS innovation and organizational change in other nonbusiness-oriented sectors, such as the health sector (Dunker, 2002; Louw, 1986, 1999), has highlighted a variety of unique, context-specific dimensions that emerge in settings different from those of typical business organizations.

Regarding the use of a theoretical approach to innovation, we argue in this article that diffusion of innovation (DoI) theory (Rogers, 1995) and contemporary innovation frameworks, such as the theory of reasoned action (Fishbein & Ajzen, 1975), the technology acceptance model (Davis, Bagozzi, & Warshaw, 1989), the theory of planned behavior (Ajzen, 1985; Taylor & Todd, 1995), and their derivatives, provide a good foundation of well-developed concepts and empirical results applicable to the study of technology adoption and diffusion. In this journal, *Information Technologies & International Development,* the articles by Roman (2003), who advocates for the use of DoI in relation to researching telecenters, and the article by Chigona and Licker (2008), who use DoI to explain rural communal computing facilities, illustrate the usefulness of a theoretical approach to researching technological innovations. However, such theoretical approaches neglect a number of issues that are important in our setting. In the context of this study, the innovation itself and the rationality embedded in it were crucially important in terms of its impact. Additionally, the innovation was imposed on the users of the systems; it was not voluntary. There was also, in reality, a process of transformation of the innovation, rather than a process of transmission, as suggested by DoI.

The objective of this article is to heighten understanding of the IS innovation process in the humanitarian context. Thus, section 2 briefly describes the humanitarian system to provide a background to the case study. Section 3 explores how innovation is viewed in IS literature, and section 4 describes the concepts and vocabulary of actor network theory (ANT) which are used in our analysis. Section 5 briefly describes the research approach adopted for this study, and Section 6 describes the process of implementation on two occasions of the newly developed Commodity Movement Processing and Analysis System (COMPAS) in Chad. Lastly, we conclude by showing how using ANT illustrates that the process of implementation of an innovation is as important as the innovation itself.

2. The Humanitarian System and the World Food Programme

Humanitarian relief organizations take on the huge tasks of saving lives and reducing the suffering of people affected by a wide range of disasters in practically every corner of the world. Most international aid flows from the world's wealthiest countries to relief efforts in developing countries. Large governmental donors exert a strong influence over the sector, as they provide the bulk of the funding for major relief and development activities. Donations are channeled through the international aid agencies to local partners in the affected countries. In most cases, it is these local partners (community-based and nongovernmental organizations), which are closest to the affected populations, that provide the final leg of the relief services to the affected populations.

Humanitarian efforts are predominantly located in poor countries, in rural and remote locations with broken or nonexistent physical infrastructure, and in host communities with limited skills and low literacy levels, as well as a generally limited potential to support or sustain IS innovation initiatives. In some

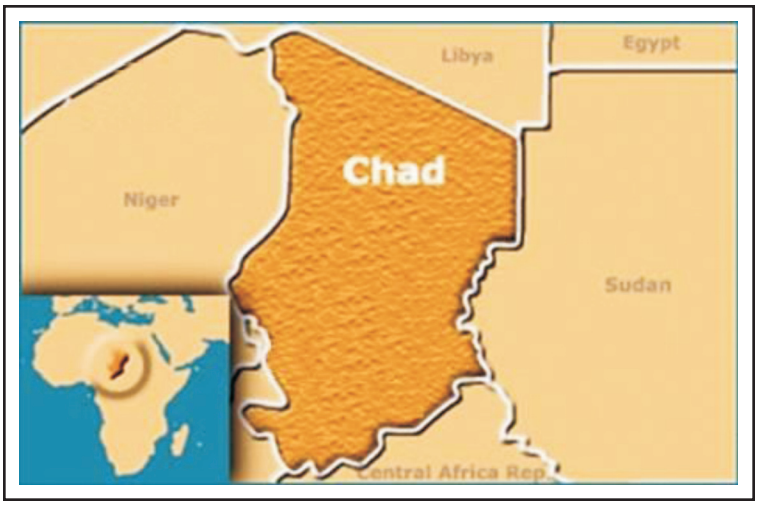

Figure 1. The Republic of Chad and Neighboring Countries (Sketch Map).

cases, the national and local governments, through which humanitarian organizations often must coordinate their activities, are severely impacted, or even uprooted in the case of a conflict situation (Relief Web, 2006). This article concerns one particular humanitarian organization, the World Food Programme (WFP).

2.1 The Organization

WFP, the food aid organization of the United Nations, is one of the key frontline agencies for humanitarian relief aid, reaching out to more than 100 million people each year in more than 80 countries worldwide. The organization's mission is to save lives and reduce the human suffering of vulnerable people—those who are at greatest risk from life- and livelihood-threatening emergency situations.

WFP has its headquarters in Rome, and it is governed by an executive board consisting of 36 member states. The organization has three main types of field (external) offices: regional/cluster offices, liaison offices, and country offices. The organization's headquarters supports regional/cluster offices and country offices through the provision of normative guidance and technical assistance, as well as through that activation of response systems. Regional offices provide strategic, policy, and overall management guidance, direction, feedback, feed forward, and support to country offices. Country offices have the primary responsibility to implement the organization's projects, in addition to emergency preparedness and response activities. Through their own networks of satellite offices, country offices are also responsible for liaison with the government, implementing partners, and other in-country actors.

Some examples of the major response systems of WFP over the years have included addressing the Iranian earthquake and the resettlement of millions of refugees in Algeria, both in the early 1960s, feeding the displaced persons in Cambodia (in the early 1980s), helping the millions affected by the El Niño in Southern Africa (in the early 1990s), and assisting the millions affected by draught in the Horn of Africa and Ethiopia (2000).

WFP has a total workforce of more than 10,000 national and international staff (professional and support staff), with more than 90% of those working in the field offices. The organization has five official working languages: English, French, Spanish, Portuguese, and Arabic.

WFP manages its response through projects. It has three types of humanitarian relief projects: 1) emergency operations for the most common emergency response activities, 2) protracted relief and recovery operations covering longer periods of support and recovery after the emergency phase, and 3) special operations for special cases, especially those requiring fast and shorter-duration interventions.

2.2 CHAD—Country Profile

The Republic of Chad, the world's fifth poorest country, is located in north central Africa. Chad's economy has been aggravated by various conflicts during its 40 years of independence, the desert climate of the north, and its landlocked position. Eighty percent of Chad's population depends on subsistence farming and herding for their livelihoods. Agricultural production is heavily affected by erratic rains, cyclical droughts, and locust infestations. The Sahara Desert takes up about 40% of Chad's land, and much of the remainder is subject to drought and desertification.

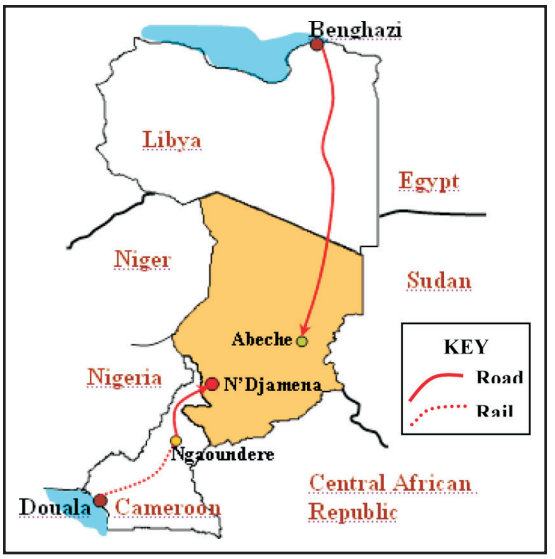

Figure 2. The Humanitarian Relief Routes for Chad (Sketch Map Prepared by Author).

Chad suffers from inadequate infrastructure, widespread poverty, and poor health and social conditions. Chad relies heavily on foreign assistance and foreign capital for most public- and private-sector investment projects. It has limited capacity to cope with the presence of refugees and relies heavily on external assistance.

2.3 WFP Activities in Chad

At the time of writing, WFP's emergency operation in the country mainly revolved around the provision of humanitarian assistance to 1) more than 200,000 Sudanese refugees who fled to Chad as a result of ongoing conflict in the Darfur region of Sudan, 2) about 50,000 Central African refugees in southern Chad who fled their homes following the conflict between the Central African Republic government forces and armed opposition, plus 3) approximately 160,000 internally displaced Chadians and members of the local communities hosting them, as the presence of refugees and displaced persons has impacted their already-strained livelihoods. The organization's emergency operations aim to balance the immediate needs of the refugees and displaced population with the longer-term needs of the host community.

The WFP country office is in the Chadian capital, N'Djamena. Humanitarian cargo for Chad comes in through two main routes: from the port in Douala by rail to Ngaoundere (in Cameroon) and then continuing by road to N'Djamena, and 2,700 km from the Libyan port of Benghazi through the oasis of El Khufra and through the desert to Abeche in eastern Chad (see Figure 2). The refugees and displaced persons have been settled in 12 camps, mostly along the borders with Sudan to the east and the Central African Republic to the south.

The working conditions in Chad can be best illustrated by the feedback from one of our interviewees, Daniella Nkamicaniye, a Burundian citizen with four years of experience as a logistics officer with WFP. Ms. Nkamicaniye was on a temporary duty assignment in Chad to assist with the emergency response initiative between November 2004 and May 2005. Her story reflects the common experiences, complexities, restrictions, limitations, frustrations, and general hardships of a typical humanitarian worker on the front line.

> *I arrived in N'Djamena in the second week of November 2004. I still clearly remember my days in Chad. It took me quite some while and effort to adjust—most probably because my initial expectations were too high. What kept me going was my commitment to the humanitarian cause and determination to have a positive impact and broaden my experience.*
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> *. . . The weather forecast for N'Djamena was 45°C, but it felt more like 50°C. The forecast did not mention the dust and sand storms. There were only two "decent" hotels and they were overbooked and very expensive. After a few days I noticed that I was the only one complaining. . . . Everybody else had learned to live with what they could get. With time I, too, compromised.*
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> *I arrived in Abeche aboard one of the small United Nations Humanitarian Air Services (UNHAS) flights. From the air I saw a massive camp with thousands of temporary structures made out of tarpaulins, old clothes, grass, sticks, and some tents. All foreign humanitarian workers had to stay in "compounds" (office and residential premises enclosed in high security fences). The living quarters were all made up of fabricated/modified [shipping] containers. All movements outside the compound had to be approved/cleared by security and closely monitored as there was a high risk of being ambushed, abducted, tortured, raped, or abused. Offices could not be established in highly volatile locations even though they might have*

been the most strategic. On several occasions stations were abandoned and equipment stolen [after rebel invasions].

I could not use my mobile phone as there were no service providers. All agencies and NGOs setup and used their own ICT infrastructure [VSAT stations, HF and VHF radio communication, etc.] and we all used satellite phones and hand-held radios. There was no public water supply system and no hospitals. The humanitarian air services were always on standby for medical or security evacuations.

. . . Field trips to camps and distribution sites on the dusty desert roads were physically exhausting and risky. Even with security clearance and regular radio monitoring and sometimes security escorts, nothing was guaranteed. You could only hope and pray that you do not land into an ambush. Not to mention the deploring conditions of the refugees and camp environment.

The diversity of cultures in the international aid community provided an interesting and also challenging working environment. But perhaps the biggest challenge was the sensitive nature of the host community. You had to be tactful and careful when talking to or addressing staff and vendors—ladies in particular—all in an effort not to offend or generate unnecessary anxiety and negative feelings towards you or the organization. . . .

When I was offered a post to stay on as an international logistics officer, I declined, even though the pay package was much higher than what I was getting back home. I felt I had done my part. One more year in this place and I would have broken down.

Decisions in these situations are critical, thus making coordination, cooperation, and timely information flows paramount. In many instances, technology-enabled ISs had been installed to assist with this decision making. The next section of this article explores the various innovation approaches in the IS literature that offer support in understanding the process of innovation for such systems.

3. Approaches to Innovation

There is a wide range of approaches to conceptualizing innovation in the IS literature. Innovation has been studied in a variety of contexts—for example, in relation to technology, commerce, social systems, and economic development. However, there appears to be a consistent theme across all settings: Innovation is typically understood as the introduction of something new and useful (Angle & Van de Ven, 2000; Damanpour & Schneider, 2006; Gopalakrishnan & Damanpour, 1997).

Organizational innovation adoption may be conceptualized as a multiphase process (Rogers, 1995; Van de Ven, Angle, & Poole, 2000). In general, though the number of phases may differ slightly, innovation is commonly perceived as being comprised of the initial force with which it is launched, the innovation's inertia, and the medium through which it moves. This way, innovation is conceived as a process which includes activities that lead to a decision to adopt, as well as activities that facilitate both putting an innovation into use and continuing to use it (Damanpour & Schneider, 2006). This adoption process has been divided into a variety of phases:

- evaluation, initiation, implementation, and routinization (Hage & Aiken, 1970);
- awareness, selection, adoption, implementation, and routinization (Klein & Sorra, 1996);
- knowledge awareness, attitudes formation, decision, initial implementation, and sustained implementation (Zaltman, Duncan, & Holbek, 1973);
- initiation, development, implementation, and termination (Angle & Van de Ven, 2000); and
- pre-adoption, adoption decision, and post adoption (Damanpour & Schneider, 2006), often referred to as initiation, adoption (decision), and implementation, respectively (Rogers, 1995; Zmud, 1982).

In general, once the innovation has been pointed out to people, it should just be a matter of time before everyone, except the most immovable, recognize its worth (McMaster, Vidgen, & Wastell, 1997). The assumption of a diffusion model is that anything can be easily explained by reference to the initial force or the resisting medium (Latour, 1986).

Over the decades, several theories of innovation, adoption, and diffusion have evolved and been subsequently extended. Research on innovation, adoption, and diffusion has more or less converged on a core set of theoretical frameworks that seek to explain adopter attitudes and their innovation-

related behavior. One of the most-cited innovation diffusion theories is that of Rogers (Prescott & Conger, 1995); it is also the one that has received the most attention in *Information Technologies & International Development* (Chigona & Licker, 2008; Roman, 2003).

According to the DoI theory, the process by which innovations spread through populations of potential adopters consists of four key elements: the innovation, the social system (which impacts or is impacted by the innovation), the communication channels of the social system, and time (Rogers, 1995). Key characteristics of the Rogers diffusion theory are the following: The focus is on determining factors that influence the rate of diffusion; the use of technology spreads gradually; there is a time lag between introducing an innovation and it becoming widely used by producers and consumers; and adoption is a decision made by the individual, whereas diffusion is the aggregate process of potential users adopting the technology.

DoI theory (Rogers, 1995) provides a good foundation of well-developed concepts and a large body of empirical results applicable to the study of technology adoption and IS innovation. Research using DoI concentrates on the new system itself, how the change agents help in its adoption, why users accept or resist the implementation, and over what time period this all occurs. However, this approach has been conventionally criticized in a number of ways. These critiques are largely attributable to:

- Inadequate consideration to the innovation itself. The approach does not incorporate organizational culture or the technological frames of reference and world views of the agent of change and the organization (Du Plooy, 1998), or the rationality and values embedded in the innovation (Avgerou, 2010).
- Sociotechnical mismatch. That is, it does not include any interaction with social systems, so issues of power, politics, and culture are not included (Bayer & Melone, 1989).
- A focus on voluntary use situations. Voluntary decisions to adopt an innovation are not common, and often, adoption is as a result of a mandate issued by higher management (Bayer & Melone, 1989). Even organizations rarely choose innovations freely (Avgerou, 2001).
- Inadequate account given to the process of "nondiffusion." That is, DoI does not explain why innovations are discarded in the same depth as why innovations are adopted (Bayer & Melone, 1989).

In summary, DoI provides an overly simplistic approach to innovation, and if IS developers want to really understand the impact of innovations on an organization, a different approach needs to be taken. Avgerou's overview of the ICT and development discourse is useful in understanding these different approaches.

In exploring the ICT and development discourse in major ICT for development journals, special issues, and conferences, Avgerou (2010) looks at two aspects of this discourse: 1) the nature of the ICT innovation process (transfer and diffusion vs. social embeddedness) and 2) the development transformation (progressive vs. disruptive). Context in the nature of the ICT innovation process is addressed differently, depending on the approach adopted. In the transfer and diffusion approaches, there is the assumption that the technologies are sufficiently independent from the social context in which they were developed to enable them to be transferrable to other contexts. This approach often uses the theories of technology diffusion and technology acceptance to describe the innovation process (ibid.). Social embeddedness is different, in that the concern is with the construction of the "techno-organizational arrangements in the local context," and one of the main objectives of studies adopting this approach is the concern with the particular context which has formed the innovation (ibid.). Actor-network theory (ANT) is a common theoretical approach found in such studies.

Through adopting this "social embeddedness" approach, ANT addresses many of the above-mentioned critiques of DoI and moves toward a more detailed understanding of the relationships between information technology and its use (Hanseth, Aanestad, & Berg, 2004). Since ANT has received considerable coverage in past issues of *Information Technologies & International Development* (Mengesha, 2010; Rhodes, 2009; Stanforth, 2006), it is not the intention to duplicate the descriptions already contained in these articles. However, an overview of the concepts (translation of innovations and mechanisms of translation) and corresponding

vocabulary, both of which are central to our article, follow.

4. Actor-Network Theory

ANT forms a different conceptual perspective by making no analytical distinction between the social and the technical. Based on this principle, ANT developed an elaborate vocabulary of concepts to describe and explain sociotechnical phenomena (Callon, 1991; Callon & Law, 1989; Latour, 1988; Law & Callon, 1992). It is through this vocabulary that ANT ideas have come to influence sociotechnical studies in IS.

The model of translation as proposed in ANT comes from a set of assumptions that are different from those used in innovation diffusion. Latour (1986) argues that the mere "possession" of power by an actor does not automatically confer the ability to cause change unless other actors can be persuaded to perform the appropriate actions for this to occur. Latour maintains that, in an innovation translation model, the movement of an innovation through time and space is in the hands of people, each of whom may react to it in different ways. They may accept it, modify it, deflect it, betray it, add to it, appropriate it, or let it drop (ibid.). In this case, the adoption of an innovation comes as a consequence of the actions of everyone in the chain of actors who has had anything to do with it. Furthermore, each of these actors shapes the innovation to their own ends, but if no one takes up the innovation, then its movement simply stops; inertia cannot account for its spread. Instead of a process of transmission, we have a process of continuous transformation (Latour, 1996), where faithful acceptance involving no changes is a rarity. The key to innovation is the creation of a consortium of actors powerful enough to carry it through, and when an innovation fails to be taken up, this can be considered to reflect on the inability of those involved to construct the necessary network of alliances among the other actors (McMaster et al., 1997).

Latour (1986) stresses that it is not just a matter of each of the actors in the chain either resisting the innovation or transmitting it in the same form that they received it, but that their shaping of the innovation is essential for its continued existence. In this, they are actors, not only clients, and everyone involved translates, or shapes, the innovation according to their own needs. In doing this, the converging interests of these actors, who at first are only "an assembly of disorderly and unreliable allies," slowly evolve into "something that closely resembles a black box" (Latour, 1987, pp. 130–131). A "black box" is the term used for an innovation when it is viewed in terms of its input, output, and transfer characteristics, and no knowledge is required of the internal mechanisms at work. The addition of each new ally contributes to the ultimate form of the emerging "black box" (McMaster et al., 1997), as the chain is strengthened and the network lengthens over space and time due to the translation of the innovation.

Callon (1986b) proposes a set of aspects, or "moments" in translation: problematization, interessement, enrollment, and mobilization. The problematization stage takes its outset in a focal (key) actor(s), who intentionally starts a change process. The focal actor defines the nature of the problem and the roles of the other actors, so that this focal actor is seen as having the answer and is indispensable to the solution of the problem.

The second moment, interessement, is a series of processes that attempt to impose the identities and roles defined in the problematization on the other actors. It means interesting and attracting an entity by coming between it and some other entity. Here, the enrollers attempt to lock the other actors into the roles proposed for them and gradually dissolve existing networks, replacing them with a network created by the enrollers themselves.

If the interessement is successful, then the third moment, enrollment, will follow through a process of coercion, seduction, or consent (Grint & Woolgar, 1997), leading to the establishment of a solid, stable network of alliances. This requires inscription to occur; that is, a process of ensuring the actors' interests in the translation process by providing evidence for the particular idea or concept (Akrich & Latour, 1992). Enrollment, however, involves more than one set of actors imposing their will on others; it also requires these others to yield.

The last moment, mobilization, is about stabilizing the actor-network by making durable relations. Mobilization occurs as the proposed solution gains wider acceptance and an even larger network of absent entities is created through some actors acting as spokespersons for others. Mobilization requires that these supposed spokespersons are properly able

to represent the others and neither betray them nor be betrayed by them (Callon, 1986b).

Some actors are mobilized more easily than others, and to understand the innovation process, it is important to examine the resistance and acceptance offered by the mobilized actors (Latour, 1991). To define the relationship between them, many actors use intermediaries, such as texts, technical artifacts, humans with specific skills, and money (Callon, 1991). These intermediaries then constitute the "form and substance" of the interactions.

This article explores the dynamics of the innovation process in the humanitarian relief context using the theory of innovation translation, informed by ANT, as an alternative to innovation diffusion in understanding issues of IS innovation.

5. Research Approach

One of the authors is an employee of the WFP. At the time of the study, the researcher was based at the organization's regional office in Central Africa, the office responsible (among others) for supporting, overseeing, and enforcing the implementation of the organization's systems and policies in Chad and five other countries in that region. This case pertains to efforts of the WFP to implement its corporate commodity tracking system in the Republic of Chad. It examines both the dynamics of the innovation process and the context within which the process unfolded—a period of almost six years of involvement for Chad.

The research took an interpretive, exploratory case study approach to study the innovation efforts by the WFP in one of its key field operations. The intention was to gain an in-depth understanding of the innovation process in a real-life setting. Such a situated study provided a clear sense of both the dynamics of the innovation process and how, within the context of the constraints and opportunities of the particular setting, technology was shaped and change was enacted.

The main advice on method suggested by ANT proponents is to "follow the actors" (Callon, 1986a, 1991; Latour, 1996), and to let the actors set the structure and boundaries of the study. This was largely the method followed in this study, so information was collected through informal interviews, discussions, personal observations, and examination of in-house documents (reports, manuals, guidelines, memos, and correspondence).

The study started in August 2004 and ended two years later. The innovation efforts in Chad took place during the period running from September 2001 to June 2006. The implementation efforts during this period can be divided into two distinct phases, marked by the introduction of the first and second version of the Commodity Movement Processing and Analysis System (COMPAS). Key locations and offices were visited in Chad and along its main humanitarian logistics corridor, the Douala corridor (Douala-Yaounde-Ngaoundere-N'Djamena-Abeche; see Figures 1 and 2).

6. The Commodity Movement Processing and Analysis System (COMPAS)

6.1 Background

Humanitarian logistics and supply chain management is a complex, but very critical, process that encompasses a range of activities, including preparedness, planning, procurement, shipping, customs and import clearance, transport, warehousing (storage) and handling, tracking and tracing, and delivery to the final destinations.

In WFP, international procurement and shipment of commodities are organized by the procurement and shipping departments at the headquarters. Information regarding the expected arrivals is passed on to the destination country and arrival port so they will be able to make the local arrangements to receive the cargo. Vessel handling, storage, clearing, forwarding, quality control, and similar port operations are usually outsourced to specialized commercial agencies. However, WFP closely monitors the discharge, storage, and forwarding of cargo and, whenever possible, sets up offices to facilitate and follow up the logistics.

6.2 The Old System (Commodity Tracking System) and COMPAS Version 1

Before 1998, WFP did not have a comprehensive corporate IS for tracking and tracing the status, movements, and location of its commodities. Each country office improvised its own system or methodology of monitoring and reporting project and operational activities, with the more advanced offices using small, standalone database systems, and the majority using spreadsheets.

One of the pioneer initiatives to automate supply chain monitoring and reporting in WFP was the

Great Lakes Region Commodity Tracking System (CTS). This came about largely as a result of pressure to automate, standardize, and harmonize supply chain monitoring and reporting during the emergency operations following the Rwanda and Burundi genocide. This system, developed by a local in-house team, consisted of more or less stand-alone database systems exchanging data through a system of replication (i.e., controlled synchronization or exchange of data sets between databases designed to ensure that changes in each are applied to the other). Over the years, the system was continuously upgraded to improve on data capture, information exchange (data replication), and reporting.

CTS had many problems, mostly technical. The programming language used was not flexible or easily adaptable. The database system could not adequately support the ever-increasing volume of data, and the developers were unable to implement a real-time and reliable data replication system. Most of the field offices did not have the required technical infrastructure. Perhaps most significant was the ever-changing system requirements (and thus, the perpetual need to upgrade). These changes were necessitated by not only the technical problems, but also by the lack of standard business processes and documentation. Additionally, the general complexities of the humanitarian working environment, which was externally imposed and outside the control of WFP, also imposed system changes.

Nevertheless, it could be said that CTS set the ball rolling. It received support from WFP's headquarters and was recommended and used in several emerging humanitarian responses at the time, and it formed the basic framework for the development of the new corporate system, COMPAS, as its design principles and structure captured the key elements and data which now needed to be improved for the wider platform.

In February 1996, the WFP executive board, the topmost decision level in the organization, approved plans to develop a new corporate supply chain tracking system. The project was officially launched in January 1997, with a team of experts and users charged with the responsibility of developing, implementing, and maintaining a corporate system that would record, monitor, and report on the organization's entire supply chain process. It would also ensure comprehensive, accurate, and timely commodity accounting and reporting on internal business processes to the donors, governments, and the general public each year. The development of a supply chain logistics IS was also seen as an opportunity to review, improve, and standardize the organization's business procedures and practices.

The main users of the system were the logistics and programming departments. Logistics and programming staff entered and analyzed data and provided information on donations, shipments, vessel arrivals, vessel discharges, stocks (either stored or in transit), losses, and distributions to beneficiaries. This information helped managers plan and ensure efficient and effective implementation of the organization's programs. COMPAS data was also used for payment of services (shipping, transport, storing, and distribution by implementing partners). Pilot testing of the first version of COMPAS started in the first quarter of 1998, and the first full implementation was in December 1998 in Ethiopia.

COMPAS was first installed in Chad in September 2001. At this time, WFP's operations were relatively small, with a small caseload of refugees from Sudan and Central African Republic and less than 3,000 tons of cargo per annum. It had field offices in only four locations. The decision to install COMPAS was based on a high-level directive to install the system in all country offices with a throughput of more than 2,000 tons of cargo per annum. Implementation costs were funded from a special fund set aside for "small" operations that was quite small at the time. An expert was sent in from the headquarters to facilitate implementation.

Five COMPAS stations were set up, and a five-day training workshop was organized for five staff: one logistics assistant (who would assume overall responsibility for COMPAS in the country) plus four data clerks (one for each sub-office).

At this time in Chad, neither of its neighbors on the two transport routes, Cameroon and Libya, had COMPAS. To cover this deficiency, the Chad country office data station was configured to take on the additional function of a port office for the purposes of recording vessel arrivals, what had been dispatched, and what had subsequently been forwarded to Chad through Cameroon. The port data entry function remained in N'Djamena (more than 1,200 km away) until December 2002, when the system was implemented in Cameroon. By the end of 2002, there were more than 300 stations worldwide in 79 WFP country offices using COMPAS.

In general, the first installation of COMPAS had many flaws and gaps, as summarized in the boxed

"The training was not enough and the business processes were complex and difficult to understand and implement."

"The system was not user friendly."

"Systems processes did not match existing operational practices. There were several mandatory system transactions that were not being recorded in practice."

"There was no reporting and data analysis module."

"The user manuals and all supporting documentation were in English, while the key users mainly speak French and Arabic."

"There were many information gaps—making data reconciliation a nightmare."

"The system had very many technical problems—which took too long to be resolved. Many fixes, patches and upgrades and their implementation required advanced skills. The capacity of staff selected and trained to use the system was below the prescribed recommendations (none had the minimum skills or qualifications)."

"There was not sufficient management buy-in resulting into a temporary stagnation. Even the few persons that had been trained were re-assigned to other more urgent/important tasks."

Box 1. Feedback Examples from First Implementation of COMPAS Review Meeting.

quotations, but at the time, there was no urgency, as this operation had a relatively low priority and limited funding. It was the events of December 2003 that brought it into the limelight and prompted action.

6.3 The New System—COMPAS Version 2

In December 2003, Chad experienced a fresh influx of refugees fleeing the escalating conflict in the Darfur region of Sudan. By mid-2004, the number of refugees in eastern Chad had grown more than threefold. The new arrivals increased demand for the already-limited resources and placed even more strain on the highly vulnerable local population. Eastern Chad operations, which, at that time, had already moved into the protracted relief and recovery phase, were reclassified to an emergency operation. The nature of operations and attention to Chad suddenly changed.

At this time, events in the Darfur region had generated a lot of media interest and public concern. The plight of the victims was well-publicized in almost all major media outlets. This brought first eastern Chad, and then the rest of Chad, into the limelight. This, in turn, triggered a large-scale donor response. Humanitarian operations in Chad started receiving new pledges, donations, and shipments. The commodity pipeline and supply chain suddenly increased in volume and complexity; new logistics routes were opened, and large volumes of supplies started coming in by road, rail, and air. There was an urgent need for accurate and timely tracking and reporting to donors (for resource mobilization and accountability), plus updates to the government and general public. Ad hoc and laid-back tracking was no longer acceptable.

When the emergency was declared, the WFP was quick to intervene with highly skilled rapid response teams from almost all functional areas, bringing with them advanced ICT equipment and supplies, and setting up new management and coordination structures. The rapid response teams, with their rich experience and superior skills, virtually overshadowed the pre-existing skeletal structure.

In the first quarter of 2004, the WFP headquarters expressed serious concerns regarding the performance of COMPAS in the Central African Region, with particular reference to Chad. At a meeting in August 2004, the performance of the commodity tracking system in the corridor was reviewed (the quotations above of the prior section provide a summary of feedback from this meeting). The general conclusion was that a new plan had to be drawn to improve COMPAS and ensure that the improved version was properly implemented, putting into consideration the lessons learned and the unique contextual issues noted in Chad and the Central African Region.

The second and latest version of COMPAS was installed and configured for the emergency. The main challenge at the time was understanding how to maintain timely and accurate accounts of the ongoing crisis on the one hand, and reconcile the old historical (incomplete and inaccurate) data entry

Table 1. Timeline of Events.

1995	CTS developed and used in several WFP operations
Feb 1996	WFP executive board approves plans to develop a corporate supply chain IS
Jan 1997	The COMPAS project is officially launched
March 1998	Pilot testing of COMPAS Version 1
Dec 1998	First implementation of COMPAS Version 1 (Ethiopia)
1999–2001	COMPAS Version 1 rolled out in many field offices
Sept 2001	COMPAS Version 1 implemented in Chad
Dec 2002	COMPAS Version 1 implemented in Cameroon (Douala and Cameroon)
Aug 2004	Workshop to review performance of COMPAS in Central Africa
Sept 2004	COMPAS Version 2 released
Dec 2004	Re-implementation of COMPAS in Chad and Cameroon (Version 2)
May 2006	COMPAS fully and effectively functional in Chad

backlog on the other. The priority at the time was the crisis. A decision was made to use a cut-off date from which to proceed with the ongoing operations, and when the situation had stabilized, to go back and carry out the reconciliation.

Due to time constraints, the organization decided to bring in experienced staff from other countries (as opposed to recruiting and training locals). The country office COMPAS database was kept in the capital N'Djamena, where there was an existing and more reliable information infrastructure, and the data entry center in Abeche (the biggest field office) was improved. A new and powerful server was purchased and installed in Abeche, and the COMPAS station was reconfigured to a network setup with four new client data capture stations (to speed up data capture). WFP's ICT infrastructure in Chad was significantly improved. In general, commodity tracking was not easy, but managers were able to get fairly reliable updates on incoming shipments, internal cargo movements, and stocks during the crisis.

After the crisis phase, the experienced emergency support teams were withdrawn—some to return to their operations, and others to support new, emerging crises elsewhere. A few staff remained, either as newly Chad-assigned staff, or as short-term assistants in the transition period. Longer-lasting structures needed to be established. However, large volumes of cargo were still flowing in, and staff deployment was still higher than before the crisis. To ensure continuous support and learning, the Chad country office created a permanent international post of logistics officer (COMPAS specialist) in N'Djamena and filled it with an experienced international staff member who was also able to communicate in French and Arabic. The Douala port office was reinforced, staff was recruited, communication systems were installed, and COMPAS was set up. Coordination and information-sharing at the port (between WFP and commercial agents/contractors) improved, and new arrangements were made with port and customs authorities to speed up clearance and forwarding of humanitarian cargo.

6.4 The Translation Process

The problematization proposed by COMPAS promoters was that COMPAS was the solution to the organization's supply chain management problem. The Chad country office needed a system that could capture and provide accurate, timely, and reliable information on the status and movement of supplies. The ad hoc spreadsheets were cumbersome to prepare, unreliable, and not easily consolidated to give a holistic view of the country office's resources. COMPAS was presented as the solution to the need for effective commodity tracking and reporting. The Chad country office management needed to fully support the implementation process, and the staff needed to be convinced to use COMPAS and not revert to the old tools.

In both innovation initiatives, the implementing officers presented themselves as the focal actors in the innovation process and strived to establish themselves as the key to the change process. They initiated the change process, defined the system

configuration and setup (data capture points, data consolidation nodes, and information flows), installed the software and set up the infrastructure, introduced new business practices and procedures, introduced new job profiles and terms of reference, and initiated new relationships for all involved in the new commodity tracking and reporting setup.

The implementing officers then embarked on efforts to get the other actors interested in the new system—to convince them of the viability of the proposed system and get each actor to fit into and accept the identities and roles defined at the start. The focal persons had several meetings and discussions with the country office management, explaining the usefulness of the new system (both for the local day-to-day operations and from the global/corporate perspective). They strived to convince management to discourage (discontinue) old tools, actively promote the use of COMPAS, and assist in the introduction and enforcement of the new business practices.

The implementing officers recruited new staff and set them up in their new roles. They organized and facilitated training and coaching sessions for all potential users, explaining new phenomena and terminologies while demonstrating the superiority of COMPAS over the spreadsheets and other tools they had previously used.

The first attempt at *interessement* was unsuccessful. The managers did not appreciate the usefulness of COMPAS. The system itself never really functioned properly. COMPAS had many technical problems that local staff could not resolve. Professional support was not readily available, resulting in extended downtime and many information gaps. From the headquarters' comments, COMPAS was actually released prematurely. Additionally, WFP headquarters did not actively support COMPAS in terms of allocating sufficient resources (human, time, financial) and allocating their own time for the implementation process. To the data entry clerks and logistic officers, COMPAS was complex: Processes and procedures were not clear, and the system menus and supporting documents were in English (Chad is a French- and Arabic-speaking country). There was always something that needed fixing, but never anybody to help. The *translation* process did not *"dissolve existing networks,"* so it was easy for everybody to resort to the old (but reliable) spreadsheets. The employees who had come on board specifically to work with COMPAS were reassigned.

A significant constraint in the first implementation was the mismatch between WFP's business procedures and reality (practice). Even though COMPAS was based on a "home-grown" solution, the *inscriptions* in COMPAS were based on assumptions of standard business practice (i.e., recommended standard procedures from headquarters). The reality was different. COMPAS was best-suited for situations that WFP controlled or had a strong influence over, but a lot of the operations on the Douala corridor were outsourced. Successful implementation implied revision of business arrangements and slight modification and improvisations in the system (the application and configuration/setup).

Interessement and *enrollment* were successful on the second attempt. The new country office management was, at this stage, convinced of the usefulness of COMPAS, having successfully facilitated its implementation and experienced its use elsewhere. They actively provided the required support, committed resources, enforced the new recommended business processes, and discontinued all alternative tools. Interest was also due to external pressure on reporting and the significant media and donor attention on Chad.

In the second installation of COMPAS, a more comprehensive, concerted, extended, and well-targeted training, coaching, and support approach was used. In other words, a concerted effort was made to "*dissolve existing networks*" and make it more difficult to return to old practices. The data entry clerks and logistic officers were specifically targeted for enrollment. They were not only trained on how to use the system, but also on IT and language skills that would enhance their ability to effectively use COMPAS and maintain the system. The support structure was improved, and manuals were translated. A French-speaking expert was permanently available at the country office, and there was additional support at the regional office. Users yielded and accepted the roles that were defined for them, and they stopped using the old tools through a mixture of coercion (refusal by management to accept anything else), seduction (additional training received), and consent (realizing that reporting and tracking were easier with COMPAS). It was thus possible, on the second attempt, to move to the next stage of *translation*.

During the second attempt, management and users not only accepted the new system and roles, but also started to actively support and promote the use of COMPAS information in other departments. Heads of departments, logistics staff, and COMPAS staff became *mobilizers* and also started *enrolling* others. The use of COMPAS spread to other departments: the program coordination unit, the finance section (for invoice processing and field monitoring of commodity distribution), and the other sections of logistics, such as warehousing, transport contracting, port operations, etc. (for inventory management, contract performance analysis, and port management). COMPAS finally became *institutionalized* within WFP and gained wide acceptance.

The role of each of the main actors in both implementation phases is summarized in Table 2.

7. Conclusion

Using an ANT conceptualization of innovation, the translation process was greatly constrained and shaped by the context. Innovation in rural and remote settings with no public infrastructure (power and communication) is not easy. WFP had to set up its own infrastructure (power generators, radio and satellite communication networks, etc.) and related IT hardware and software. This not only required extra resources (funds and manpower) to purchase, set up, and maintain them, but it also implied an increase in the scope of innovation, as these advanced technologies were also new to the field staff, and most of the locally recruited staff had no previous experience with such technology. The perceptions and attitudes regarding the technologies were not an issue, as it was the complete lack of knowledge about technology for supply chain and logistics management that was the constraint. Low literacy rates slowed the implementation process, and it was clear from the country office staff's response that staff development and training were important components of the innovation process.

During the innovation process, there were many activities competing for resources and priority. The activities were fast-paced, and tension among employees was high, as they were stressed and overworked. It was not easy to generate and sustain interest, especially during the first phase, when COMPAS had many remaining bugs. The innovation process required persuasion to generate and sustain that interest; the attitude that the staff had "no time for experiments" needed to be addressed, and there was the need to match COMPAS with the reality of business processes and procedures.

We conclude from the experiences referenced in this article that the nature, dynamics, and context of the humanitarian business are significantly different from business firms in a free market context. The humanitarian "business" is unique from other businesses in respect to the conditions, circumstances, and dynamics that form the environment in which it typically operates. However, the dynamics of translation from headquarters to a local branch are likely to be familiar to many. ANT theory proved useful for a humanitarian organization analysis, in that it provided an understanding of this essentially different sociotechnical organizational context of the innovation process, which prevented translation from occurring, and then subsequently enabled it to do so.

The second conclusion of this article is that, although DoI theory (Rogers, 1995) and contemporary innovation frameworks provide a good foundation of well-developed concepts and empirical results applicable to the study of technology adoption and IS innovation, they do not apply well to the complex scenarios and innovation phenomena presented by the humanitarian context. DoI ignores the rationality and history of the origins of the innovation, and as a result, it ignores the rationality and values embedded in that innovation (Avgerou, 2010). Furthermore, the adoption of COMPAS was a corporate decision; it was a question of when to implement, not which system to implement. The changing external environment also impacted other social and organization networks, which impacted the network of actors in the innovation process.

In this case, technological innovation itself was not enough. The success of the tracking system could only be achieved if there were also successful adoption and implementation of the new policies, procedures, and practices (related to logistics and supply chain management, such as transport, warehousing, contracting, port operations, etc.). The overall implementation process had to be coordinated and synchronized across many adopters distributed across multiple departments, organizational layers, and geographical locations. Where the system originated in this case ultimately affected the shape of the innovation and the process by which it

Table 2. Actors and Their Roles in COMPAS.

Actor and Description	Role in COMPAS Implementation 1	Role in COMPAS Implementation 2
WFP HQ (includes the executive board and senior management)	• Support based on CTS • Issued directive to use the system • Expert sent to assist	• Deployed rapid response teams that were highly skilled • Approved and allocated funds to the project
WFP Country Office (management at country office level)	• Minimal buy-in to need for system • Minimal financial, human, and time resources	• Permanent post of logistics officer (COMPAS specialist) • New country office management staff • Communication in French and Arabic • New staff recruited in neighboring countries • Infrastructural support handled internally
COMPAS Project Team (project manager, coordinator, team of experts, and WFP staff)	• Focal actor in innovation process • Initiated change process, defined systems configuration, installed software and infrastructure • Overall planned, coordinated, and facilitated deployment	• As phase 1, but additionally defined business processes • Introduced new job profiles
COMPAS (Commodity Movement Processing & Analysis System)	• Replaced old ad hoc tools and incorporated all business processes, though processes in reality did not match system processes • Responsible for capturing the complete WFP supply chain • Aimed to provide accurate and timely information, but encountered difficulty incorporating historical data and had many technical problems	• Cut-off point decided for historical data • Revised business processes and arrangements • Revised application and configuration
Users (logistic assistants and data clerks responsible for data capture, analysis, reporting)	• 5-day training received • Problems dealing with bugs in systems and had little external support for the system • Manuals in English (French and Arabic being the local languages of communication)	• More comprehensive, concerted training on system • Included training to improve IT and language skills • Extended and well-targeted training, coaching, and support • Manual improved • Stopped using old ad hoc tools • Effectively used the IS when all bugs and glitches were fixed
External environment (internal conflicts, the Darfur crisis, and the resulting influx of refugees into eastern Chad)	• Low volume of humanitarian aid	• With Chad as emergency situation increased media coverage • Increased media promoted attention to the crisis and prompted action/response • Increased aid demanded accountability and transparency from WFP
Business procedures and practices (new and old)	• Introduction of COMPAS resulted in review of business processes and practices; business process did not match systems in practice	• Revised business standard operating procedures to match systems in COMPAS

was implemented. DoI does not illuminate the network mechanisms by which actors (social and technical) interact. It becomes important during adoption, but it does not help to explain the mechanisms by which social factors become influential in adoption success or failure. This leads to the third conclusion, that social theories can assist with understanding the innovation process in the humanitarian context.

The core theoretical position in any study of ISs and organizational change is the relationship between the technology and the social institutions and contexts in which they are deployed. This article supports the argument presented by Lee (1999), postulating that an IS and its organizational context have transformative effects on each other: therefore, if we want to explain these mutual effects, the focus of investigation must shift from the evaluation of the effects to the study of the process that produces them. The dynamic interplay between the technology and the organizations is the condition that has to be analyzed to gain a better understanding of the effects of the adoption of information technology in organizational settings (Lee, 1999).

As an alternative to innovation diffusion, the theory of innovation translation offers an approach to explaining innovation that does not rely on any supposedly innate nature of the innovation, nor on specific characteristics of the change agents or society, but rather, on a process of network formation in which all actors seek to persuade others to become their allies in promoting the acceptance of their own view of the way the problem can best be solved. The translation model allows us to focus on understanding how actor-networks are created, strengthened, and weakened, rather than on causes and effects. ■

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