



Electronic trading and the process of globalization in traditional futures exchanges: a temporal perspective

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Abstract

This paper develops a temporal perspective to examine information and communication technologies (ICT) adoption and processes of globalization. The foundations of our theoretical approach explicitly draw upon three intersecting planes of temporality implicit in structuration; namely reversibility, irreversibility and institutionalization. We further develop our theoretical perspective by extending the scope of structuration to incorporate temporal features of Adam's social theory on 'global time'. We then use this temporal perspective to examine the emergence of electronic trading and the process of globalization across London and Chicago futures exchanges. Our analysis provides insights into the IT-enabled reconfiguration of these exchanges during processes of reproduction and change associated with globalization. We conclude with some key implications for e-trading strategy and consider changes in trader work life associated with the adoption of e-trading.

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Introduction

It is widely agreed that world financial markets are a key organizing force behind globalization in contemporary times (Boden, 2000; Guillen, 2001). Visions of 24-h trading, operating electronically and instantaneously, imply a global logic within these markets, which are increasingly driven by technological scale and information flows rather than foreign trade and investment (Guillen, 2001). Globalization is often constructed as an impersonal and inevitable force, with markets driven to 'go global' by a dramatic increase in the adoption of information and communication technologies (ICTs). For example, in the futures markets over the last decade, the spread of satellite technology and the emergence of automated electronic trading systems have had a significant impact on the development of futures trading.

However, such a techno-centric view does not adequately capture the complexity of globalization processes, with notions of 'global logic' often obscuring interconnectivity with more dynamic 'local logics' (Boden, 1994, 2000). Furthermore, there has been widespread acknowledgement of the critical role that ICTs play in processes of globalization enabling new organizational forms across time and space (Walsham, 2002) and fuelling fundamental societal change (Castells, 1996). Our empirical study seeks to further our understanding of this phenomenon through an examination

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of the processes of change related to ICTs and globalization across financial markets. The use of ICTs in financial markets is important as they are often viewed as being at the spearhead of globalization and their development is seen as critical for world development (Castells, 1996; Sassen, 1998, 2000, 2002).

Early IS literature on globalization examined the impact of IT on the structure of international firms, seeking to coordinate and control interdependencies among geographically dispersed multi-site operating units. Advanced information technologies, such as electronic data interchange, groupware, and extranets reduce communication and transaction costs, and manage complex interdependencies between nations and across global industries (Malone *et al.*, 1987; Peppard, 1999). These and other technologies are critical in developing a global IS infrastructure (Ives and Jarvenpaa, 1991; Steinbart and Nath, 1992) for multi-national corporations (MNCs) to coordinate new organizational forms such as the global network organization (Jarvenpaa and Ives, 1993) or the trans-national configuration (Boudreau *et al.*, 1998).

The role of ICTs in facilitating increasing interconnection of markets is another key debate on globalization in the IS and international business literature. Specifically, IT infrastructures are believed to provide important 'location' advantages to local market clusters, which helps attract investment and enhance their competitiveness. Advanced IT infrastructures can have important implications for firm strategy in making investments into local clusters (Dunning, 1998; Enright, 2000; Zaheer & Manrakhan, 2001). Furthermore, the geographical transformation and complexity of globalizing financial markets has been widely explored in the literature (Thrift & Leyshon, 1997; Boden, 2000), with an emphasis on a simultaneous consolidation and differentiation of spatial forms into mega cities (Sassen, 1998, 2000, 2002) and networked financial communities (Castells, 1996).

Although these studies acknowledge that time and space are inextricably intertwined (Harvey, 1990, 2001), their relative treatment of time is by comparison very much in the background and often limited to fairly narrow concepts of clock time such as time zones, velocity, and speed. Instead of interrogating the spatial qualities of new trading arrangements, we seek to bring temporality to the foreground by exploring the dynamics of change associated with the competitive landslide to electronic trading across interconnected global futures markets.

In so doing, our temporal perspective avoids a deterministic logic on IT and organizational transformation (Scott Morton, 1991; Hammer and Champy, 1993; Applegate, 1994) in which IT is treated as a causal agent and described as a driver or force (Robey, 1997). Instead, we explicitly theorise the role of IT in processes of globalization and seek to understand its involvement in the interconnectivity between local action and global consequences (Boden, 2000) across time and space.

A few notable studies (Orlikowski *et al.*, 1996, Barrett & Walsham, 1999) have examined the inter-related levels of transformation associated with IT. Specifically, these studies recognize the underlying importance of time and space in their theoretical developments and highlight how increased levels of globalization facilitated by IT are interconnected with profound changes in personal identity.

We build on this stream of research by developing a distinctive temporal perspective for understanding ICTs and processes of globalization, with a particular focus on the emergence of electronic trading in and between traditional futures exchanges. A temporal perspective is particularly relevant in these exchanges where traders trade in some future price of a commodity, and experience a multiplicity of temporal and spatial frames.

In the next section, we develop the theoretical basis of our temporal perspective, which is then followed by a description of research methodology. The penultimate section draws on key elements of our temporal perspective in presenting an empirical analysis of electronic trading in traditional futures markets. We then conclude the paper highlighting key contributions of this temporal approach for understanding ICT and globalization in contemporary times, including a discussion of practical implications for electronic trading in traditional futures markets.

Theoretical foundations of temporality

The foundations of our perspective for understanding ICT and globalization explicitly draw upon time and temporality in the theory of structuration (Giddens, 1984, 1995). We begin this section by briefly highlighting how structuration has been used in related IS literature and supports the theorizing of IT. We then develop our temporal perspective by explicitly integrating the temporal features of structuration with Adam's social theory of time. Table 1 summarizes the three theoretical elements of our temporal perspective and its associated key concepts.

Structuration theory and our conceptualization of ICTs

The IT literature and broader organizational literature have long recognized the usefulness of structuration theory (Giddens, 1984) in tracing the nature of interactions between agency and structure within major social change processes (Walsham, 1995; McNulty & Ferlie, 2002). We do not attempt to review this growing literature or assess the different approaches to its use. Instead, we briefly highlight the key tenets of the theory and how ICTs can be incorporated within the theory.

The theory of structuration develops the concept of the 'duality' of structure (Giddens, 1984). Giddens argues against dualisms, whereby the individual and the societal level are viewed as separate, with human action taking place outside of social structure. Rather, the 'duality' of structure views structure and action as mutually constituted through interaction (Child, 1997); that is,

Table 1 Temporal perspective of understanding ICTs and the process of globalization

Theoretical elements	Key concepts
Reversibility in global time	<ul style="list-style-type: none"> • ICTs facilitate flow and exchange of money with its endless 'circularity' reinforcing the time–money–power cycle • Global structuring and rationalization of clock time has led to standard time zones and world time as a pre-condition for global finance • Temporality of electronic networks facilitates instantaneity with simultaneity and enables a 'global present'
Irreversibility in global time	<ul style="list-style-type: none"> • Recognition of the finite life cycle of an individual; 'being unto death' • Time is constituted by the emergence of events that dynamically constitute and potentially alter the past/present/future relationship • Nonlinear networked processes in global time constitute significant uncertainty • Under conditions of uncertainty, individuals are reflexive in achieving a coherent self-identity through the adoption of risk positions at each moment of emergence
Institutionalization in global time	<ul style="list-style-type: none"> • Market participants are situated, always embedded, and operate in a socio-political environment • The introduction of ICTs may involve a shift in power relations among individuals in different groups with divisions of interest; this may lead to structural contradictions and even conflict if one group is able and motivated to act

structure enables and constrains action and is simultaneously the outcome of action (see Jones, 1999, 2003 for extensive reviews).

Our conceptualization of ICTs is within the 'ensemble view' of technology (Orlikowski & Iacono, 2001), which highlights that technology is enmeshed or embedded in historical and cultural aspects of their ongoing development and use in organizations and across industries (Barley, 1986; Orlikowski, 2000; Walsham, 1992, 1993; DeSanctis & Poole, 1994; Crowston *et al.*, 2001). ICTs are designed, constructed, and used by people, and they are shaped by their interests, values, and assumptions. Within this ensemble view, our conceptualization of ICTs is one of 'technology as structure'. ICTs are viewed as a human artifact, constructed and enacted through human action, with institutional properties that simultaneously constrain and enable such action (Orlikowski & Robey, 1991, Walsham, 1993). From a structural perspective, ICTs form an important link between action and structure. Specifically, ICTs are drawn upon in social interaction to provide meaning, to exercise power, and encapsulate sets of norms, and in so doing reproduce or change social structures (Walsham, 1993).

Temporality, structuration, and global time

Structuration theory recognizes the role of time and space as central features of social systems (Giddens, 1984). Furthermore, structural analysis, with its fundamental emphasis upon relationships between structure and action over time (Crowston *et al.*, 2001), implicitly uses a temporal analysis. However, despite this underlying importance of time in structural analyses, we argue that time needs to be more explicitly theorized (cf. Adam, 1990, 1995) in understanding ICTs and processes of globalization. Few studies (Barley 1988; Orlikowski and Yates 1999, 2002) have explicitly developed a temporal perspective drawing on structuration theory; whereby

temporal structures are both constituted by and constitute social practices (Orlikowski and Yates, 1999).

In our theoretical basis, therefore, we bring temporal features in the theory of structuration to the foreground. Specifically, Giddens (1995) suggests that there are three intersecting planes of temporality involved in every moment of social (re)production; each interpenetrating without having any logical primacy over another. As shown in the left-hand side of Table 1, they include: reversibility of time or the continuous flow of day-to-day (*duree*) activities, irreversibility of time that recognizes the finite life cycle of an individual (*Dasein*), and institutional time (*longue duree*) involving the long-term sedimentation of the development of social institutions. We then extend the scope of these ideas on temporality by incorporating Adam's (1990, 1995) analysis of contemporary social times. A key emphasis in her analysis is on 'multiple times' (Adam, 1995, 2000, Whipp *et al.*, 2002) and in this regard we focus on the connections and mutual implications between temporal features of globalization and (industrial) work time. Drawing on this integration of Giddens (1995) and Adam's (1995) work, we now develop three key theoretical elements of our temporal perspective: reversibility in global time, irreversibility in global time, and institutionalization in global time.

Reversibility in global time Reversibility reflects the Newtonian perspective of time as a continuous flow, cycle, or repetition of day-to-day life. It has manifested in work (industrial) time as 'clock time'; the (human) creation of time as abstract, commodified, decontextualized, and disembodied from events (Adam, 1995, 1998). Adam notes that clock time is conceived during industrialization as money and power and tied to work and economic exchange. Furthermore, the time–money–power link helps to establish connections with the economic goals of efficiency and profit. Our first

key concept in Table 1 suggests that technology often facilitates and reinforces this dimension or plane of temporality. Specifically, ICTs facilitate flow and exchange of money with its endless 'circularity' reinforcing the time-money-power cycle.

A second key concept of reversibility in global time notes that global structuring and rationalization of clock time has led to standard time zones and world time as a pre-condition for global finance. Furthermore, without the development of IT and electronic communications, such processes of globalization related to the complexity and uniqueness of global times would have been inconceivable.

An important dimension of complex global times is the new level of interconnectivity in financial markets (Giddens, 1999) such as traditional futures markets where problems in one market have inescapable and often unpredictable effects on the rest of the markets worldwide. The influence of these instantaneous effects of communication along with the simultaneity of networked relations has seemingly replaced succession and duration of industrial (work) time; the present extended spatially to encircle the globe creating what Adam (1995) calls a sense of a 'global present' (Adam, 1995). With the use of electronic trading, events in one financial market have instantaneous effects on other markets across the globe, and are largely beyond the control of those involved. Our third concept therefore suggests that temporality of electronic networks facilitates instantaneity with simultaneity and enables a 'global present'. As we discuss later, ICTs therefore allow for the colonizing of time (zones) through 24-h trading across futures markets.

Irreversibility in global time In contrast to the Newtonian perspective on time, the temporal plane of irreversibility recognizes the finite life cycle (span) of an individual, or 'being unto death'. This conception of time finds its basis in individual experience and, as Heideggerian scholars would say, in the 'action of becoming'. Adam (1990) draws on Mead's (1934) concept of emergence to emphasize that the connections and relations between the past/present/future are dynamically constituted and potentially altered. Only *emergence* in the present has a reality status, the past and the future being real only with respect to their relation with the present. In other words, the past changes with respect to our reflections in the present and the revised meaning we then give to it. Each emergence irreversibly affects everything else, not just the meaning of all past and future but all of present reality and its possible futures (Adam, 1990).

In this way, emergence refutes linear causality of change processes and goes beyond classical theories on the separation of past, present, and future. Instead, as our second key concept highlights, time is constituted by the emergence of events, which dynamically constitute and potentially alter the past/present/future relationship. The shaping of strategic action by relationships between past, present, and future has been highlighted as a critical

temporal consideration in the strategy literature on time (Clark, 1985, 1997; Ramprasad and Stone, 1992; Butler, 1995; Mosakowski & Earley, 2000). We draw on this concept in our analysis of the process of globalization by being sensitive to how strategic action is influenced by the past/present/future relationship, as they are dynamically constituted and potentially altered with each emergence.

Our third key concept of irreversibility in global time recognizes that nonlinear networked processes in global time constitute significant uncertainty. Such uncertainty has implications for individuals whose everyday lives are increasingly influenced by events that take place on the other side of the world. In seeking to maintain a reflexive coherence of self-identity, individuals adopt socially constructed 'risk positions' (Beck, 1992; Giddens, 1990, 1991). By assuming risk positions, individuals seek to manage uncertainty and implication of change for both their personal and professional life. In sum, our fourth concept recognizes that under conditions of uncertainty, individuals are reflexive in achieving a coherent self-identity through the adoption of risk positions at each moment of emergence.

Institutionalization in global time Giddens emphasizes the interpenetration between the planes of temporality by highlighting that 'every moment of social interaction, implicated in the "passing away" of the human organism (irreversible time), is likewise involved with the *longue duree* (or institutionalization) of institutions' (Giddens, 1995, p 20). Similarly, Whipp *et al.* (2002) highlight that while the economic exchange or flows of money may be conceived in abstraction with endless circularity (reversible conception of time), the economy or financial markets operate in socio-natural environments (institutionalization time). Thus, one of our key concepts of institutionalization in global time suggests that market participants are situated, always embedded, and operate in a socio-political environment.

Furthermore, the introduction of ICTs such as electronic trading systems may be perceived to facilitate a shift in power relations within and between groups as individuals may have divisions of interest. Giddens (1979) suggests that these power relations may lead to structural contradictions or even potentially conflict if actors are motivated and able to act (Giddens, 1984; Walsham, 2002). These developments are summarized in Table 1 as our second key concept of institutionalization in global time.

Research methods

We adopted an interpretive longitudinal IS case study approach (Zuboff, 1988; Orlikowski & Baroudi, 1991; Walsham, 1995) to examine the emergence of electronic trading and the transformation of traditional global futures exchanges in London and Chicago. We observed and collected data on changing circumstances, perceptions, and actions, both over time and as they occurred

through in-depth interviews, direct observation, and analysis of documentary material. Our key research question sought to understand how the emergence of e-trading was related to the process of globalization across traditional futures exchanges. The importance of this phenomenon was recognized at the beginning of the study when a number of critical incidents occurred. The reversal of the decision by the traditional London International Financial Futures and Options Exchange (LIFFE) to expand its physical trading floor ('pits') in July 1998 was our first clue. We quickly learned that this was related to the loss by LIFFE of its prized Bund contract to the rapidly growing German electronic exchange. Later that year, the criticality of electronic trading was further reinforced when it was announced as the 'Brave New World' theme of the Futures Industry Association Conference, which hosts the largest gathering of industry participants worldwide.

Our research approach examined the strategic development of a number of competing ICT developments on electronic trading systems in global futures markets. We began by compiling a historical account of ICT development and use for financial market trading. Alongside this, we examined real-time electronic trading developments by different market participants and the strategic responses to them by leaders of individual exchanges. The risk positions of traders and the potential implications for e-trading on their work life were documented using the research process described below.

Data collection

Our research sites were the traditional London and Chicago futures exchanges, namely LIFFE, the Chicago Board of Trade (CBOT), and the Chicago Mercantile Exchange (CME). These exchanges accounted for in excess of 60% of the world's trading volume in futures contracts at the start of the study in 1998. We started our longitudinal research in London in August of that year, and this was followed up by fieldwork in the Chicago markets. In all, 65 interviews were conducted on-site in London and Chicago with stakeholders in the financial futures markets, particularly the CME, the CBOT, and the LIFFE. Our semi-structured interview questions examined a number of themes, including the timing and response of exchanges towards electronic trading, the technology architecture of the trading engine, the competitive and cooperative strategies exchange leaders were adopting in managing the change in global futures markets, and implications for traders' work life. We also attended panel sessions of key industry conferences in London, Chicago, and Frankfurt, which increasingly focused on the emergence of electronic trading in these markets. They were very useful in not only deciding and making contacts with key informants for the research but also as a way of comparing, contrasting, and further developing our understanding of the key themes emerging from the research. The questions following the panel sessions of industry sessions provided a good balance of the different

'voices' in the markets, which were often polarized with some participants aggressively supportive of electronic trading and others challenging the effectiveness of e-trading in providing liquidity in increasingly volatile markets. Yet others debated the continued role of exchanges and brokers in this changing landscape of the market.

Apart from traders, we also interviewed independent software vendors in these markets, which were particularly important players in the implementation of their strategy for the new millennium. During our interphase analysis, we continued to identify further participants in the Market to interview as suggested by the high-level themes in our data. So, for example, issues of governance of the exchanges, regulatory issues of electronic trading, the increased importance of the clearing business, and the proliferation of alliances emerged as key additional themes. In response to this, our interview questions in subsequent phases were modified to include these issues and our fieldwork design extended to include interviews with managers in clearinghouses, regulatory bodies, and alliance partners.

As Barley & Kunda (2001) note, mixing observation with real-time interviews is important when studying work practices and their changing nature over time. We therefore took the opportunity to observe pit-trading activities in Chicago exchanges. Observation of the Chicago pits provided us with an opportunity to understand the language of hand signals in pit trading and its culture. This not only helped us to become much more familiar with the trading environment and implications for traders but also allowed us to compare and assess our observation notes with the transcripts of research interviews, which deepened our understanding of the expected benefits and drawbacks of electronic trading. We also observed traders in their homes and in trader arcades engaged in electronic trading and were fortunate to have veterans educate us as to the new dynamics and the rules of the games of these virtual pits.

Finally, in addition to these methods of observation, current organizational documentation from exchanges, brokers, clearing houses, regulators, as well as conference materials were studied and analyzed. A strategy of historical reconstruction was also adopted in the study to understand and unearth key events, strategies, and practices within the exchanges. Studying historical documents and newspapers, as well as asking key informants with a long history of the exchanges to assist in the historical reconstruction was most helpful in this regard. This process of cross-validation of documentary data to the themes emerging from interviews and observation allowed 'within method' data triangulation and increased interpretive validity (Jick, 1979).

Data analysis

Both researchers had a similar theoretical background, were experienced in previous projects on IT strategy and implementation, and attended the interviews together in

order to develop a shared in-depth knowledge of the project. This proved a considerable advantage during the data analysis phase enabling them to support each other's inductive processes as they worked through an open coding technique. Each researcher undertook their own initial coding and conceptualization by carrying out a careful (re)reading of, and reflection on, empirical data. Interview transcripts and other documents were examined to identify participants' statements that reflected interpretations surrounding the adoption and use of electronic trading in futures markets, and their subsequent strategies and actions. The key participants included: senior managers at LIFFE, CBOT, CME, ICT implementation teams at these exchanges and the DTB, third-party software providers, and traders both working in the physical exchanges or on-line.

In the meetings that followed, extensive discussions took place to comb through any initial difficulties and confirm 'shared' meaning or raise alternative interpretations for consideration. In this way, key concepts, themes, and issues emerging from the data were identified and subsequently sorted into categories. Our clustering strategy involved shifting the level of focus from micro to middle-focus and macro in order to see if a critical mass collects around a theme. During the early stages of interrogating and patterning the data, we gave particular care to the semantic process of naming themes that were emerging and the association that we drew between different sets of data. We were conscious that this process could significantly influence how one links the themes and treats them in the future. Eventually, a set of main themes were chosen and these were then used as a starting point to develop a more detailed understanding of the empirical 'landscape' from a further level of data organization. This was a dynamic process involving the pruning and/combining/addition of the themes and helped us in managing the analysis.

After each phase of analysis, we reflected upon the way in which our data collection strategy should develop based upon the themes that were emerging. We also engaged in a reflexive process with the academic literature in order to understand how the themes and their associated meaning compared and contrasted to key conceptual/theoretical and management issues. Throughout this iterative process, we drew on Giddens' temporal perspective and Adam's social theory of time to develop a conceptual scheme for understanding ICT and processes of globalization, which was then used to re-examine our field data.

The emergence of e-trading and the transformation of futures exchanges

This section analyzes our case study of electronic trading in traditional futures exchanges using our temporal perspective for examining ICTs and the process of globalization. We first briefly introduce the broader context of traditional futures exchanges, open outcry

(OO) trading, and the status of electronic trading in these exchanges.

The major traditional international financial futures and options exchanges are the CME, the CBOT, and the LIFFE. These exchanges are self-governing membership associations that serve as an umbrella for member firms and provide efficient price discovery. Traders in colorful jackets assimilate new information from satellite links feeding digital video display (DVD) screens on the walls of the exchange and trade in open auction through a system of OO, backed by hand signals in physical trading 'pits' (marketplaces). Although confusing and bemusing to the uninitiated, this price discovery process facilitates fair and efficient market prices.

The primary economic function of futures exchanges for endusers is the risk management provided by hedging contracts, which allows the construction of flexible strategies:

Hedging is the process of minimizing risk by taking an opposite market position to the original risk. It is the reverse of speculation although, confusingly, the two are sometimes hard to tell apart (Thompson, 1998).

Derivatives used for hedging offer risk management to industries like farming by presenting an opportunity to protect businesses from adverse conditions in an uncertain world (CBOT, 1996), which may otherwise negatively impact their profitability.

Since the very first electronic trading initiative, Globex, was conceived and developed by the CME, a number of purely electronic futures exchanges (some growing rapidly) have evolved, in particular the emerging dominant Deutsche Terminborse (DTB). Electronic trading on the major traditional futures markets has been limited to the margins and regarded as a supplementary, after-hours mechanism; for example APT at LIFFE, Project A at CBOT, and GLOBEX at CME. Traders have long since proclaimed that OO is the only way to ensure liquidity, and to cope with the large volume of trades that may occur as a result of periodic fluctuations in the markets (Managing Director, Strategic Director, London Clearing House, 1998).

At the time of our research in 1998, the Chicago exchanges dominated the industry, and the hegemony of OO was taken to be the norm. Controversy concerning the use of electronic trading was sparked by two key events. The first was the competitive shift and subsequent loss of a major international benchmark product, the German Bond contract, from the OO environment at LIFFE to an electronic trading system run by the DTB. Secondly, a New York-based brokerage company launched an electronic trading system designed to compete directly with the trading facilities and products offered at the Chicago Board of Trade. Before analyzing the role of these events in understanding ICTs and processes of globalization, we start out by tracing the

historical development of e-trading systems in global futures markets.

Early ICT development and use by the CME in going global

Table 2 structures the key findings of our analysis of the first e-trading initiatives and how they relate to key concepts identified in Table 1. For presentation purposes, we have, in some cases abbreviated the definition of key concepts.

Reversibility in global time During the 1970s and 1980s, Chicago, the birthplace of financial futures contracts, enjoyed a large market share as futures contracts became accepted as standard tools for risk management the world over. In the mid-1980s, The CME Strategic Planning Committee examined their industry in the context of very competitive and technological pressures and highlighted globalization as the most critical issue facing them with their traditional OO system of trading. They recognized that ICTs made possible the shift from autonomous financial markets, operating in their different time zones and independent of external pressures, to a continuous marketplace. These developments threatened their cosy existence as geographical monopolies, as they now faced new opportunities and challenges associated with the '24-h trading day'. With globalization, every exchange had become a direct competitor to all other exchanges. For example, the LIFFE in London was establishing its own Eurodollar pit, and this threatened the future of CME's products in Asian time zones. The ex-chairman of the

CME reflected on his challenges in preserving market share and maintaining dominance in his Exchange's futures contracts (e.g. Eurodollar contracts) across time zones:

I knew that we couldn't copyright anything. ..By 1982 they (LIFFE) had a Eurodollar market.. I found out that they were in a better position from a time zone point of view than we were...The way things were, Asia could wait a couple hours and use the London market, and the London market lasted long enough into our day and Asia closed, so, in fact, they (LIFFE would) capture Asia. We would be left with just North America. (Interview, 1998)

Since the Eurodollar contract was just an idea that could not be copyrighted, this exchange leader was anxious to somehow maintain control and ownership of his exchange's proprietary contracts across time zones.

Our temporal perspective would highlight that ICTs embody a system of meaning around a continuous marketplace and a '24-h trading day', and have the potential to re-order power relations between and across financial exchanges. ICTs also allow the instantaneous and simultaneous distribution of information across all time zones, which call into question the distinct division of the three major time zones in which these exchanges were used to operating. This also relates to the uncertainty inherent in global time as experienced by the CME leader who sought to maintain his Exchange's dominance in market share and profit across all time zones to reinforce their existing time-money-power link.

Table 2 ICTs, globalization, and the colonization of time zones at the CME

<i>Theoretical elements</i>	<i>Key concept</i>	<i>Illustrations from the case study</i>
Reversibility in global time	Standard time zones as a pre-condition for global finance ICTs facilitate exchange flows and time-money-power cycle ICTs facilitate instantaneity and simultaneity enabling colonization of time	<ul style="list-style-type: none"> • ICTs facilitate a continuous marketplace that threatens the exchange as a geographic monopoly with its own time-money-power cycle within specific time zones • ICTs allow 24 h trading and potential colonization of futures markets across time zones, involving a re-ordering of power relations between and across exchanges
Irreversibility in global time	Uncertainty in global time leads to reflexive monitoring of identity and adoption of risk position Process of emergence revises past and alters the past/present/future relationship	<ul style="list-style-type: none"> • Uncertainty associated with ICTs and globalization led to the development of mutual offset as a risk position to protect/expand CME futures contracts across time zones • Leaders question the appropriateness of Mutual Offset and revise this risk position in favor of the development of the Globex system
Institutionalization in global time	The introduction of ICTs may involve a shift in power relations among individuals in different groups with divisions of interest; this may lead to structural contradictions	<ul style="list-style-type: none"> • Disagreement on governance rules of Globex ensues between trading partners of established exchanges • Political interests by traders as owners of these mutual exchanges with a proclivity to OO trading thwart implementation of Globex

Irreversibility in global time Leaders' anxiety concerning the potential uncertainty associated with ICTs and globalization has led to reflexive monitoring as to the appropriate risk position they should adopt. The response by the CME leader was the pioneering development of an electronic linkage, via a system of "mutual offset" (MOS) between the CME and the Singapore futures exchange SIMEX. MOS linked the trading capability of two different markets in two different time zones; going that one step closer to proving a global market. In effect, it proved that markets in separate time zones could be linked to allow access to each other's open interest, thereby giving both markets the advantage of the other's non-regular trading hour business flows. For example, trades started in the United States could be 'offset' and completed in Singapore, and vice versa. As such, the MOS allowed the 'stretching' of trading practices so as to colonize time zones. In this way, the CME was successful in thwarting LIFFE's attempt to start a Eurodollar market as the initiative died before it got started.

The designers of the MOS electronic linkage drew on temporal features of instantaneity and simultaneity in colonizing time zones and allowed the CME to preserve and extend local Eurodollar contracts across Asian and North American time zones. In addition, the MOS linkage also relied on the speed of transactions and the flexibility of re-arranging or restructuring trading practices between separate exchanges and across time zones.

The MOS, while successful in maintaining the CME's dominance and extending trading hours of the Eurodollar had its limitations. For example, the linkage was not successful for all financial instruments and could not cover the entire 24-h trading period. Even more importantly, it was viewed as a risky if not dangerous trading scenario. Market leaders were uncomfortable with transferring their products to other markets and relying on 'absent others' to complete trades:

So the idea of transferring your product to another time zone can be done...Now how do you transfer? The ultimate way to transfer is not to transfer [your product], but in fact to transfer your market....I don't have to deal with anybody. [It would] just be my market traveling across the sun....So, Globex was born to [do such a] transfer and not make any more mutual offset deals. The hell with those things because you know those are dangerous by comparison, those aren't your markets, you're dealing with partners, you know. Globex is yours. (Interview, 1998)

Leaders reflexively monitored their earlier decisions about using MOS to reinforce the time-money-power link in light of uncertainty about its long-term effectiveness and riskiness of using partners in other financial exchanges. An alternative 'risk position' adopted by CME leaders was to develop an electronic trading system, Globex, to retain control by transferring their own market (instead of product/contracts) to other time zones, and in so doing facilitate '24-h trading' across global markets. The underlying philosophy of Globex as a

global, interactive, shared system for futures and options was to ensure that no partner exchange relinquished their autonomy, but rather continued to clear and guarantee its own products. The CME sought to enroll key global exchanges, including its arch rival, the CBOT, and later on the French exchange MATIF, with Reuters as the network provider. Globex as a global 24-h trading system would allow the exchanges to maintain existing structures of domination in their established products across all time zones. The chairman of CME at the time put it this way:

We said to the world, look, we only want what's ours. You come join Globex. Put your product, that will open after your business day is closed, on Globex. You'll pay us a little fee, but we won't trade your product. That is, we will trade your product but it will be your product. A cross exchange arrangement for all exchanges in the world. That's the unified theory of Globex. (Interview, 1998)

Institutionalization in global time Despite this initial and somewhat bullish optimism, significant challenges, delays, and eventually lack of participation by key partners ensued. These challenges stemmed largely from disagreement on governance rules guiding the development of the e-trading infrastructure:

I think we got into very complicated governance structures where we felt that the Mercantile Exchange or Reuters were really in control of our future destiny and that did not sit well with us or our members the GLOBEX System I think became a very, very complicated governing structured with ... you know ... who gets admitted ... who does not get admitted ... and so on ... and you know the governing structure probably more than anything led to the demise of our participation in GLOBEX. (LIFFE Interview, 1999)

In addition to these governance challenges between Globex development partners, there were governance challenges between traders and senior managers within the CME. Specifically, there were structural contradictions between these groups who did not share common interests concerning the role and use of e-trading in the exchanges. E-trading was perceived by many traders as a threat to their own livelihood and monetary value; and by default their voice and power in the running of the exchanges. As one interviewee put it, 'Turkeys don't vote for Christmas' (MD, Strategic development, LCH, 1998). Instead traders resolved to maximize profits by reasserting their dominant *status quo*, a strategy that in their minds made more sense than responding to the distant threat of lost market share from competing methods of trade.

Furthermore, electronic trading remained the "political impossible" (Former CEO of CME, 1998) as the dominant coalition of traders were, in fact, the owner/members of these mutual exchanges, which resulted in low levels of support for the e-trading initiatives. In fact, for almost a decade after the initial development of Globex, electronic

trading was relegated to an 'after hours' trading option among all the major exchanges in London and Chicago. Despite the development of smaller electronic exchanges in the late 1980s and 1990s, OO remained the dominant 'truth' for futures trading in these major traditional markets throughout this period. This persistence of the *status quo* would remain the same until two critical events occurred across the industry, which as suggested in the following sub-section was related to the process of globalization involving dynamic change processes within and between traditional futures markets.

The loss of the German bond contract at LIFFE in London

Table 3 structures our findings on the development of the Globex trading system by analytically drawing on some key elements of our temporal perspective.

Reversibility in global time Firstly, the spectacular loss of LIFFE's key German bond contract, the Bund, to the electronic DTB exchange was widely heralded as a watershed:

It's the snowball effect... once it begins to go..... we saw the Bund (German bond contract) go..... it went from us having 70% (LIFFE)/30% (DTB) to 60% (LIFFE)/40% (DTB) and then it (all) went in a period of about a couple of months... it's quite phenomenal when it happens, you see your business disappear. (LIFFE Interview, 2000)

This surprise loss appeared to defy the law of markets, which suggests that once significant liquidity of a benchmark product had been established, it would

remain dominant in that market. So, in this case the trading of the Bund contract that had traditionally been traded on the LIFFE exchange shifted to the DTB exchange. Although astute observers appreciated that politics played a key role in this loss, nonetheless, the focus of attention was leveled at the threat of e-trading. LIFFE's strategic response in July 1998 was to start the process of dismantling their mutual governance structure in favor of a 'for profit' entity, and to implement a state-of-the-art e-trading system, LIFFE CONNECT. LIFFE's ambitious goal for this system was to establish technological superiority by trading complex hallmark products such as short-term interest rate contracts (STIR), a feat that was previously believed to be unachievable. The loss of the Bund contract not only shocked LIFFE traders in London but also rang warning bells across the industry globally. In Chicago, leaders at both the CME and CBOT carefully studied, with some dis-ease, the 'surprise loss' and migration of the Bund, clearly facilitated by electronic networks and now recognized as repeatable across other financial markets including Chicago.

Irreversibility in global time Perhaps, for the first time in 15 years in Chicago since the initial electronic trading developments began, floor traders in Chicago started to question the taken for granted hegemony of OO pit trading. However, there was still a lot of resistance by a number of traders in making a possible transition to electronic trading, viewing recent e-trading developments as a threat to their livelihood, 'the end of life as a trader.' At the same time, Chicago leaders were

Table 3 E-trading and the interconnection between London and Chicago exchanges

<i>Theoretical elements</i>	<i>Key concepts</i>	<i>Illustrations from the case study</i>
Reversibility in global time	ICTs facilitate flow and exchange of money with its endless circularity influencing the time-money-power cycle Nonlinear temporality of electronic networks repeatable across markets	<ul style="list-style-type: none"> ● The use of e-trading by the DTB Exchange leads to a shift in the time-money-power cycle with the loss of the German Bond contract in London ● Concern that the critical mass effect of e-trading that led to the loss of German bond contract in London would be repeated in Chicago
Irreversibility in global time	Recognition of the finite life cycle of an individual; 'being unto death' Under conditions of uncertainty, individuals are reflexive in maintaining a coherent self-identity through risk positions	<ul style="list-style-type: none"> ● Floor traders were concerned that e-trading adoption will mean that their days are numbered ... 'end of life as a trader' ● Leaders unsuccessfully seek to increase the use of e-trading in Chicago as a risk position against the uncertainty associated with the loss of the Bund in London
Institutionalization in global time	Market participants are situated, always embedded and operate in a socio-political environment Power relations associated with the introduction of ICTs may lead to structural contradictions between individuals in different groups within and across the exchanges	<ul style="list-style-type: none"> ● Exchange leaders are situated in a mutual exchange structure and this constrains their ability to exercise their risk position despite recognition of the threat of e-trading's critical mass effect demonstrated in London ● Structural contradictions between leaders and traders surrounding the development and use of e-trading lead to conflict as traders successfully resist any further adoption of e-trading

more open, and wary of the unprecedented non-linear temporal feature of e-trading that leaders at both the CBOT and CME exchanges viewed through the lens of critical mass adoption:

The migration of the business of the German Bond business from London to DTB did not happen overnight. This was a seven or eight year process ... where DTB's market share was five and ten and fifteen percent ... they got up to about thirty percent of market share ... [at which point] they have critical mass ... and once they have achieved that critical mass ... as soon as they got fifty percent of the market it was all over ... (Head of Operations CBOT, 1998)

Critical mass goes this way. The competitive market has 20 percent market share, that's okay. When it has 30 percent, one starts to take notice of their competitors. At 45 percent you've already lost.... Before you know it, in no time, it goes to 70 percent. Game over. (ex-Chairman CME, 1998)

Chicago exchange leaders clearly appreciated the non-linear networked processes of electronic trading, and sought to adopt a risk position, which significantly enhanced the level and use of electronic trading within their own exchanges.

Institutionalization in global time Despite this strategic intent, there were too many stakeholders dominating the exchanges' governance structures for which it represented upheaval or redundancy, and members continued to vote against the expansion of electronic trading. For this senior CBOT strategist, it was difficult to ascertain whether it was one's strategic approach with regard to competition or the governance structure of a traditional exchange that was the paramount challenge:

The reason for it (lack of responsiveness to e-trading) is perceived to be the traditional membership ... ownership structure.. as well as [over]confidence in our position in the market place ... so that you let your competitor get too much of a foot hold ... I don't know ... I think it is more [an issue of the] governing structure You know ..those are the things that are difficult in managing the exchange convincing your members the change is in their best interest. (CBOT Interview, 1998)

In global times facilitated by e-trading floor trading members, as the dominant powerful coalition owning the exchange, feared having a future in this brave new world. OO remained the trading choice of members in Chicago, which led to the reproduction of deeply embedded structures and practices. Floor trading members had structural contradictions with exchange leaders and were still able and motivated to resist:

The new economics of virtualization and the evolving roles of exchange members are posing hard choices for US exchanges. They are historically heavily rooted in providing the environment and the opportunity for members to trade and their tendency to respond to members' demands rather than staking out strategic leadership positions to propel change in futures markets. (CBOT Interview, 1999)

There was little change at the Chicago exchange until a second critical event took place closer to home involving the threat of a local competitor adopting e-trading to compete in their markets.

Local competition and the process of globalization in Chicago exchanges

Table 4 draws on some elements of our temporal perspective in analyzing and presenting some key findings on the effects of local competition for the emergence of e-trading and processes of globalization in Chicago exchanges.

Irreversibility in global time In 1998, a New York-based brokerage company, Cantor Fitzgerald, launched an electronic trading system designed to compete directly with the trading contracts offered at the CBOT. In the wake of the German Bond being stolen from under LIFFE's nose, and an appreciation of the non-linear nature of e-trading adoption, the CBOT Board members decided to take no chances:

Our board and strategy committee made the decision ... NO ... move forward with our competitive response NOW... ..[at that point] we actually announced we will begin trading electronically. (CBOT Senior Manager, 1998).

The CBOT exchange responded to this rude wake-up call, with the Chairman proclaiming that they must be 'competitive and visionary to remain the industry leader...[and will] make a pre-emptive strike on any entity that might emerge as a competitor'. In quite a turn about, the CBOT membership voted overwhelmingly to prioritize the development of electronic trading, and provide 24-h side-by-side access to their after-hours electronic trading system, Project A.

As the CME chairman noted, the leaders attempted to influence members' attitudes towards rapid adoption by drawing on both past and global (at a distance) threats:

And in one respect LIFFE 's experience with DTB electronically stealing the product was one of those things that happened...that helped us greatly to be able to say 'Look over there, look what is happening over there – **But by the way** if you look at the electronic markets ... and LIFFE ... and Paris shutting their trading floors...these are pretty big things [that could happen here or become necessary in the future].

Consistent with the concept of emergence, the local 'backyard' threats in the present revised the meaning of the events at the distant exchange, LIFFE, in the past and lent a new urgency to CME's future. The present CME chairman explained:

Last Aug (1998) – LIFFE was about to go out of business ... it was pretty bleak over there and [later on there was] a sense of despair here because – People in April (1999) after local threats emerged- said 'how long is that going to take' and I said 'You know, it is going to be 4 ,5 or 6 months ..' ...they said 'we'll be dead by the third quarter' ...there were so many newspaper articles that every day were saying 'will the exchanges

Table 4 E-Trading, local competition & globalization in Chicago exchanges

Theoretical elements	Key concepts	Illustrations from the case study
Reversibility in global time	Global structuring and rationalization of clock time leads to standard time zones as a precondition for global finance ICTs facilitate flow and exchange of money with its endless circularity reinforcing the time–money–power cycle	<ul style="list-style-type: none"> • ICTs enable traders to trade in multiple markets across time zones (24-h trading) • ICTs such as e-trading have put competitive pressure on exchanges to increase their opening hours in an effort to reinforce the time–money–power cycle
Irreversibility in global time	Time is constituted in emergence of events that dynamically constitute and potentially alter the past/present/future relationship Recognition of the finite life cycle of an individual; ‘being unto death’ Nonlinear networked processes constitute significant uncertainty Under conditions of uncertainty, individuals seek to maintain reflexively a coherent self-identity through risk positions with each emergence	<ul style="list-style-type: none"> • The emergence of a local competitor in Chicago revises the ‘past’ significance of LIFFE’s loss of the Bund and highlights the uncertainty of non-linear critical mass effects associated with e-trading • Traders are reflexive about the exchanges closing imminently ... ‘being unto death’, and adopt side-by-side e-trading as a risk position • Exchange leaders form alliances and develop technology acquisition strategies as risk positions to colonize the future against present and future competitors • Traders are reflexive about their identity, including the nature of their expertise, embodied or embrained, in the e-trading environment
Institutionalization in global time	Market participants are situated, always embedded, and operate in a socio-political environment	<ul style="list-style-type: none"> • Chicago traders are situated in a global socio-political financial market

close?’...What is their future?’ So people were saying 6 to 8 weeks.

Actors at all levels shared this urgency and concern for a future in both London and Chicago exchanges as e-trading was gradually accepted as a key trading approach across all exchanges, or as a global future. Traders across all traditional futures exchanges (Chicago and London) recognized e-trading as a global threat that permeated their present and involved a lack of certainty for their long-term future.

In managing globalized uncertainty, exchange managers adopted risk positions by forming alliances and developing technology acquisition strategies. Chicago and London exchanges deemed alliances to be necessary if they were to extend distribution and expand offerings in the provision of a truly global futures market that met traders’ demands. In Frankfurt, leading industry figures gave this movement voice at the Futures and Options World conference in March (2000):

...a company cannot hope to develop everything themselves if they want to be timely. [Our company] has a group whose sole focus is to manage alliances...It is difficult for *any* organization *alone* to make profit. (Chairman and CEO, global institutional brokerage firm)

CBOT formed an alliance with their electronic exchange competitor EUREX (a joint venture exchange based on the DTB and a Swiss exchange) on a ‘non-compete’ basis to ward off a possible future in which the

European-based EUREX exchange might enter the US market. The alliance, called a/c/e (alliance CBOT EUREX), would allow CBOT to colonize the future by effectively buying time. The exchange would be able to save financial resources at this critical point and reposition itself strategically in the face of serious competitive threats:

A major aspect of the business alliance (between Eurex and CBOT) is financial resources. Do we have the money to spend \$200 million to develop the latest and greatest right now? No. So this allows us time to market and saves us a lot of money in getting, maybe not the latest technology...We are facing real competitive threats..so let us establish ourselves. (Interview, 1999)

Meanwhile, the CME launched ‘Globex 2’ with the Paris exchange, based around the French MATIF’s electronic trading system NSC. In 1999, they subsequently formed an alliance with LIFFE. Unlike the a/c/e/arrangement, the primary objective of this alliance was a defensive strategy to colonize the future against other potential non-exchange competitors. The current senior policy adviser of the CME explained:

Ours was defensive in terms of futuristically. We recognized that creating this strength between us it would be very difficult for a competitor to come in. But there wasn’t the immediacy of that competition that we were concerned with as it was with the CBOT and Eurex....In this case we are just

saying by doing this we fend off any potential competitors of some future year.

As such, exchange leaders adopted a number of reinvention strategies in managing their risk position for survival. These strategies have not only had significant consequences for the identity of the exchanges as geographic monopolies but also on trader work life and expertise.

Reversibility in global time In recent times, there has been increasing awareness and concern of the social implications of technology that facilitated 24-h trading in an industry renowned for its compulsive greed:

I think very seriously about ... the social implications of technology...With 24 hours trading....People (already) do get stressed but they don't switch off, they carry on regardless because the drivers of money and short-termism and employment all those sort of things, everything is much more ruthless in corporate life now.. (Interview 2000 Director, Futures and Options Association)

While the extent to which '24-h trading' is a reality is debatable, the longer opening hours of exchanges is a reality. In addition, we met a number of younger traders, graduates of prestigious colleges, who would often work electronically from midnight to six, catch the opening of the Asian and European markets, and then trade in the Chicago pits for a few hours the following day. Not only were these traders trading in multiple places and markets but also they were increasingly 'flexible' in their work habits that were dictated by the time zones, opening and closing hours, and the expanding hours of operation of futures exchanges worldwide.

Institutionalization in global time As the senior Director of the UK Futures and Options Association noted, in global times there is a distinctive pace implicated by technology, which has its own tempo and associated stress:

It's the pace which people are now expected to work and it's the pace that technology now demands that you work because, it is so immediate, it demands an instant response...mobile phones are now doing absolutely everything, poor you, you know waking up at three o'clock to trade and it's going to get worse...therefore it becomes more stressful because you don't have time to think.. there's no pausing in the process of things. (Interview, 2000)

While the new intellectual breed of trader, particularly in Chicago, may start out trading in both pit and electronic markets, there was more of a marked transition for those who only ever knew the pit-trading environment. As one senior trader, who successfully made the transition from pit trading to the screen highlighted, the basic underlying skill still involved getting a feel of movement of prices. The type of knowledge involved was now more 'embrained' and relied less on 'embodied' knowledge so dominant in pit trading. As this senior trader put it:

You develop a feel for the movement of prices on the screen and you get a message from them. ..as you do in the pit... but there is a difference [in the type of message]. The average trader in the pit relies very much on his eyes and body language and feel. You can't rely on that upstairs in an electronic environment. You have to learn technical analysis fundamentals. Not to say they don't learn that on the floor. They don't use it [as much], they don't depend on it as heavily.. You have to create some thought process, some opinion process in your mind...Right now (in screen trading) what I am doing is reacting to price movement and technical analysis which I couldn't do when I was in the pit. (Interview, 1998)

There were key implications for different types of traditional pit traders as to whether they could adapt and thrive in the evolving electronic markets. Each type of trader had distinctive risk positions, which depended on expertise, linked to their existing trading techniques and had implications for their ease of adaptation. A senior manager at the CME who started in the pits and was now an active e-trader explained:

Local traders are all different. There is the one that trades the smallest increment of trade...buys and sells thousands of times a day with very little risk. That trader will have a very difficult time in an electronic environment. Another trader trades larger increments...he takes a position based on price movement. That trader will be able to learn how to do the same with other utilities on the electronic environment. Then there is the trader that has a system [of trading in the pit]. These guys will have much less problem transferring their knowledge [from the pit to the screen] because the same theories apply[in the pit and on the screen] ...price movement and differentials. (Interview, 1999)

The ability for traders to transition successfully to electronic trading was even more critical at LIFFE, which had successfully implemented its technological platform, LIFFE Connect, and closed all its pits within 18 months. The transformation of the Chicago markets was less dramatic with the development of a hybrid market of pit and electronic trading coming into effect by the end of the research in 2000. Nonetheless, it was expected that at some point in the future the pits may close; the market players and customers deciding how and when the exact date of this transformation would take place.

Discussions and Conclusions

In this section, we highlight the benefits of using our temporal perspective for future research on ICT and globalization and specifically in understanding e-trading and the globalization processes across traditional futures markets. We conclude by synthesizing and developing some implications of our analysis for traders in traditional futures markets.

Our temporal perspective, which brings the implicit temporal features of structuration theory (Giddens, 1984) to the foreground and infuses these features with a contemporary analysis of global times (Adam, 1990, 1995, 1998), has been valuable to gain an understanding

of the complex dynamics associated with the processes of globalization. Through our analysis, we highlight the importance of recognizing the three intersecting planes of temporality, namely reversibility in global time, irreversibility in global time, and institutionalization in global time, which are involved in reproduction and change.

As the key illustrations highlighted in Tables 2–4 suggest, this temporal perspective helps unravel the complexity of globalization processes by going beyond the relationship between the global and the local to the personal or individual level (Adam, 1995). Our temporal analysis helps us to appreciate the interconnectivity of global logics suggested by reversible time in global time (e.g. standard time zones and ICTs reinforcing the time–money–power cycle), local logics manifested by institutionalization in global time (e.g. locally situated and deeply embedded socio-political environment), and the individual level represented by the irreversibility in global time (e.g. recognition of a finite life cycle of the individual who is reflexive of their self-identity and adopts risk positions). This theoretical basis is particularly appropriate for IS research as it recognizes that distinctive temporal features of global time are reflective or analogous of electronic networks (cf. Adam, 1995), and allows us to examine, at multiple levels, strategic action related to ICTs and processes of globalization.

Our case analysis, taken as a whole, provides insights into the emergence of e-trading and processes of globalization in traditional futures markets. The global logic of ICT and globalization in facilitating 24 h trading threatened the time–money–power cycle of exchanges in their distinct time zones as geographic monopolies. The perceived threat to this dominant exchange's geographic monopolies 'being unto death' (irreversible time) led CME leaders to adopt risk positions through the development of ICT innovations such as the MOS and Globex. However, these electronic trading developments stalled and remained limited to the periphery of Chicago trading as 'after-hours trading' for over a decade due to the institutionalized (deeply embedded) practices of OO, the perceived inadequacy of e-trading to provide sufficient liquidity, and critically the change in power relations and potential threat to the livelihood of pit traders as exchange owners.

Within the plane of institutionalized time, the theoretical element of structural contradiction with its focus on the division of interests between groups, and the possibility of conflict was useful in understanding the reproduction and change within the exchanges. Trader members as seat owners of these mutual exchanges were able to block further development of e-trading, reproducing embedded practices of pit trading through their vote and so reinforcing their time–money–power link.

The concept of emergence was particularly useful in understanding the complex processes of reproduction and change within and between exchanges associated

with two critical events. Firstly, the loss of LIFFE's German bond contract to DTB seemed to have a negligible visible impact on the day-to-day trading in the Chicago pits, although exchange leaders became acutely aware of the non-linear networked processes of e-trading that were attributed to the rather exceptional situation where the traditional law of markets was seemingly defied. However, the second critical event in the form of a local threat from a US broker revised the meaning of the loss of the Bund contract for trader members and their assessment of appropriate strategies for present and future e-trading. With the emergence of this event, there was a dynamic reconstitution of past/present/future relationships. Chicago leaders were now able to convince trader members that e-trading constituted a 'global' future for all exchanges, and so needed to be more fully embraced by the Chicago exchanges to secure a possible future. Traders faced with such globalized uncertainty of e-trading reflexively monitored their prior voting against e-trading and adopted a risk position that allowed e-trading to coexist side by side with traditional pit trading.

At the irreversible temporal plane, traders face enormous challenges in reflexively maintaining a coherent self-identity. In particular, as owners of the exchange they were confronted by the urgent need to restructure radically in order to survive. On the one hand, they recognize their finite life cycle as '(pit) traders being unto death' (with the emergence of e-trading). On the other, they must take seriously the local threats that revise the meaning of the Bund loss and the potential consequences for their exchanges 'being unto death'. Furthermore, exchange managers adopt risk positions that are dependent on the perceived level of uncertainty and their available resources. Specifically, our case suggests that 'flexibility' in global time to enhance efficiency and profit involves hedging or speculating on technological investments to manage uncertainty and establish risk positions. A number of different types of strategies were adopted ranging from: survivalist defensive alliances to buy time in the present (CBOT), to defensive ones aimed at colonizing the future (CME), and re-invention through technology development (LIFFE).

Implications of e-trading for traders in traditional exchanges

Our case also highlights how the process of globalization extends into the personal, particularly the implications of 'flexibility' for trader work life and the evolving nature of expertise.

Specifically, with the advent and increasing pervasiveness of e-trading, traders need to be 'flexible', stretching and re-zoning their own trading day as they jump time zones through their computer screens to operate in markets where the cream of profits can best be derived. As Beck (2000) notes, we all live more and more in a 'glocal' manner where people belong in different worlds and are tied or 'married' to several places (and times) at

once. This is analogous to our futures traders who operate across markets and time zones at a more frenzied pace.

With the increasing pervasiveness of e-trading, the nature of expertise also changes as traders in these traditional markets (esp. Chicago) need to develop the necessary skills to trade effectively in virtual pits as well as physical pits. In such a transition, the skills of trading in a pit get relocated and redefined/represented from physical cues such as eyes and body language, order flow, and noise in getting a feel for movement in price to further reliance on intellectual skills such as technical analysis to get a feel by creating a thought process for the price movement. There is a resonance with Zuboff's (1988) pulp and paper operators who in the newly 'informed' organization rely less on the sentient and embodied skills for process control and more of the information provided by the technology in the control room. Our case helps to appreciate the implications of informing in global times. As Beck (2000) might argue, it is not so much that the pit and its inherent trading skills and games are delocated but that the local specificities are globally relocated into the virtual pit. This is not a smooth process without casualties; transformation comes hand-in-hand with conflict as changing competitive pressures determine who can effectively participate and in what ways. The losers will be those whose skill sets and expertise are no longer regarded as relevant or valued in this new trading environment where e-trading may undermine local ways of trading. For example, traders with a more limited set of skills who carry out basic 'in and out' strategies of 'tick trading' (buying and selling in quick succession) will have a difficult time matching the rhythm and tempo of computer-triggered trading.

We close by highlighting how our case reinforces the need to take seriously the complexity of multiple times along with their connection and mutual implications (Adam, 1995, 1990), in understanding the process of globalization. As we have suggested, futures traders are

developing new time reckoning mechanisms seeking profit by participating in multiple marketplaces across multiple time zones. In so doing, trader work life is influenced by multiple times with their connections and mutual implications. First, e-trading allows the trader to maximize profit by trading more flexibly in different marketplaces across time zones. This need for increased flexibility has implications for the biological time of the trader when he works (or sleeps) in colonizing the night time for trading. Furthermore, there are connections to technological time as mobile technology facilitates additional flexibility (any time, any place) and speed of communications of trading.

While the impact of ICTs on individuals' work-home life balance is increasingly pronounced in other areas of contemporary work, traders in these exchanges are particularly susceptible to becoming work 'dopes' in these global times as our temporal perspective illuminates. Traders may use technology to colonize time zones and reinforce their time-money-power cycle (reversible), being aware of their limited time as a trader (irreversible time), in an industry long renowned for greed and with an emphasis on large profits (institutionalization).

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