# Capital markets integration: a sociotechnical study of the development of a cross-border securities settlement system

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**Abstract**: Digital information and communications technologies (ICTs) are transforming capital markets. The integration of capital markets is seen as one such area of transformation. The research presented in this article studies one integration initiative that took shape around the proposed combination of a number of key European securities marketplaces through the development of a cross-border settlement system. Taking a sociotechnical approach, the research presents the positions of the key actants identified in relation to key controversies regarding the development of the settlement system and shows how the relations between the controversies and the positions of the actants involved in them evolve. By examining the role of ICTs in the evolution of these relations, the study seeks to illuminate the complex causalities between the social and technical aspects of cross-border capital market integration. The article argues that in addition to enabling the interconnecting of an expanded set of transacting parties, ICTs bring important cognitive dimensions that enable the inspiration, planning, and foresight necessary for both developers and market participants to formulate their plans, strategies, and positions vis-à-vis the expanded and transformed marketplace arrangements.

**Keywords**: Securities; markets; marketplace, technology, integration, globalisation, settlement, CSDs

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# 1. Introduction

Since the early 1970s, securities markets have been transformed through the adoption of digital information and communication technologies (ICTs) both for the conclusion and post-trade processing of transactions (Donald, 2013; Lees, 2011; Norman, 2007; Valentine, 1988; Wells, 2000). The adoption of such technologies has fostered huge increases in the volume and speed of trading, the introduction of novel and innovative products, processes, and organisational forms, and intensified competition among market participants trading on particular venues as well as among trading venues themselves (Lees, 2011; Schmiedel and Schönenberger, 2005). ICTs have also been seen as making possible the integration of still separate national securities markets, an issue that is particularly relevant in the EU where there is a drive to develop an integrated capital market for Europe (Giovannini Group, 2001; 2003).

Such moves to integrate securities markets provide opportunities to better understand the complex causalities driving the establishment of trans-national capital marketplaces and the broader globalisation of finance which underpin much financial innovation (Norman, 2007; Schmiedel and Schönenberger, 2005; Skinner, 2007). This is because instances of market integration provide an occasion to study a financial market 'in the making' (MacKenzie, 2005; MacKenzie, 2009) when it is possible to gain a better understanding of the way a marketplace is put together and how the reciprocal shaping of the social groups and technical entities involved in the process takes place by making visible the interactions between technological development, trading venues, market participants, and national and international regulatory bodies and policy-makers (Cerny, 1994; Knorr-Cetina, 2005). Furthermore, studying market integration can provide insights into how liquidity is not only fragmented but also constituted in the techno-social transformations of these markets put in motion by the introduction of digital ICTs.

To do this end, the article presents a study of one such European market integration initiative that took shape around the proposed integration of a number of key European securities settlement systems, which are the systems in which, following a trade, the securities traded and their ownership are transferred in exchange for a payment. The initiative studied brought together international central securities depository (ICSD) Euroclear and the central securities depositories (CSDs) of the UK and Ireland, France, Belgium, and Holland. It is important because it was the first attempt to establish a truly cross-border marketplace for securities in which the whole set of property rights pertaining to the securities covered would be maintained across the national jurisdictions integrated. So, for example, after integration the owner of French securities in the UK would have exactly the same property rights as one in the UK and would be able to trade those UK securities through the same account and in the same way as the French ones. The study follows the development of a single ICT-based system that would make possible the settlement across borders of securities transactions between these national marketplaces.

Based on this study, the article seeks to develop a broader theorisation of a securities market as market 'place' (Hetherington, 1997) and how 'place' can be reconfigured and transformed through ICTs. By focusing on the dynamics of the relations between the emergent ICT system and key market participant groups (system operators and developers, market participants, regulators, EU and national authorities), the study seeks to describe how digital ICTs relate to the reconfiguring of 'place', and more generally, to phenomena of financial markets globalisation (Appadurai, 2001; Knorr-Cetina, 2005; Sassen, 2005). This, in turn, enables a better understanding of how technological change relates to social change in the form of changes to commercial and geo-political competition, new product and services development, regulation, and policy-making within the emerging landscape of digital global finance.

The structure of the article is as follows: In the next section, the research is positioned in the broader context of studies of financial markets as sociotechnical innovations and a case is

made for the focusing on post-trade arrangements. After presenting the main research question motivated by these studies, the article goes on to outline the research approach taken for the collection and analysis of the empirical material used and the research setting studied. It then presents the empirical case studied and the analysis of this empirical material collected. Following this analysis, a discussion is developed to addresses the main research question posed and the literature and theory that motivated the study. The paper concludes with a summary of the implications the research in terms of theory and practice, its limitations, and the future research directions it opens up.

## 2. Research context

In order to understand better how the complex sociotechnical linkages that constitute markets and marketplaces are established in practice and how they make possible the market integration that is so important to the globalisation of finance and to financial innovation (Diaz–Rainey and Ibikunle, 2012; Lees, 2011; Schmiedel and Schönenberger, 2005), it is important to study what Thrift calls, the “basic sendings and receivings of sociotechnical life – and the modest but constant hum of connection and interconnection that they make possible” which have been neglected or relegated to obscure infrastructures (Thrift, 2004, p.175).

Securities settlement systems have been among such obscure capital markets infrastructures, despite being core components of financial marketplaces. Figure 1 illustrates how the settlement system relates to the other stages of a typical securities transaction.

[Figure 1 here]

As can be seen, settlement is of core importance because no securities transaction entered into on an exchange is complete without the mutual obligations entered into by the transacting parties being discharged through the reciprocal movement of the stocks and money being exchanged, from one transacting party to the other (Callon and Muniesa, 2005; Millo, Muniesa, Panourgias et al., 2005). Settlement systems are crucial to this because they 'script' these interactions in a way that reconciles the need for the legal determinacy that must underpin the ownership and transfer of titles to securities and other financial instruments with the need for the operational flexibility that makes possible the most efficient deployment of the scarce collateral (cash and securities) of market participants (Sommer, 2001). The intermeshing of time and space this involves acts as "a kind of socio-spatial glue" that contributes to the broader defining as a 'place' of particular markets (Thrift and Leyshon, 1994, p.322). The establishment of new 'place' resulting from the integration of existing financial marketplaces will, therefor depend on developing appropriate settlement arrangements so that claims and obligations are managed in an orderly, acceptable, predictable, and incontestable way in such an expanded marketplace (Millo et al., 2005).

Growing interest in financial globalisation, systemic risk, and the efficiency and resilience of market infrastructures are lifting the clearing and settlement arrangements of financial marketplaces out of their obscurity and highlighting their importance to the functioning of these markets (Devriese and Mitchell, 2006; Schmiedel, Malkamäki and Tarkka, 2006; Van Cayseele and Wuyts, 2007).

From humble 'plumbing' (Norman, 2007), these arrangements have now become key strategic locations in terms of defining the boundaries of a particular financial marketplace or trading venue and formatting the complex relationships that link together participants into a defined market community. The boundaries that defined particular financial marketplaces and trading venues have started getting renegotiated and the systemic implications of the inter-linkages that compose them are of more concern (Lees, 2011; Norman, 2007). The strategic position of the settlement systems at the confluence of the institutional and

technological arrangements of financial marketplaces makes them an ideal vantage point from which to study the interaction and mutual shaping between the human and technological involved in the development of cross-border financial marketplaces, especially with regards to the role of ICTs in these processes.

Within this context, the clearing and settlement activities of financial markets have started to be seen as an integral part of the broader sociotechnical processes that structure and organise economic exchanges in these markets, contributing to their calculative functions and giving them their particular characteristics (Millo et al., 2005). This is because the legal, institutional, fiscal, economic, administrative, governance, risk management and technological structures with which actual financial marketplaces are entangled – and for which clearing and settlement systems are a central nexus – are increasingly viewed as fundamental to the functioning and outcomes of these markets (Bernanke, 1990; Callon and Muniesa, 2005; Millo et al., 2005; Pirrong, 2002).

### *2.1. The importance of settlement systems and CSDs*

One crucial area of the intermeshing of time and space suggested by Thrift and Leyshon (1994) as valuable in studying the constitution of financial centres, relates, in the case of securities markets, to the property rights associated with securities and the transfer of these rights. The key institutional and technological entities in this transfer of property rights in most securities markets are central securities depositories (CSDs) (see Figure 1), which act as an interface between the market and the legal and fiscal regimes of particular jurisdictions (Donald, 2013).

CSDs used to be the venues at which the physical securities certificates were stored and in which they would be physically moved from the account of one counterparty to that of another upon the completion of a transaction and the confirmation of the delivery of the payment by the opposing party in the trade (Donald, 2013; Norman, 2007; Wells, 2000).

While the physical transfer of securities between holders has been replaced, first by the transfer of records on legers as ‘book entries’ (immobilisation) (Donald, 2013; Wells, 2000), and then by the changing of digital electronic entries in databases (dematerialisation) (Donald, 2013; Norman, 2007), CSDs remain crucial entities in the definition of ownership over securities and the property rights and obligations that go with that ownership.

While at first glance securities settlement might appear as a straight forward process, the increasing use of securities for lending and as collateral for payments and covering obligations means that the role of the CSDs and the ICT systems they use for settlement is far from simple (Committee on Payment and Settlement Systems, 1995; Schmiedel and Schönenberger, 2005). Furthermore, the need for legal certainty and finality necessary for transactions to be completed in an incontestable way make it imperative that even the slightest time discrepancy between the payment and delivery is avoided in order to reduce the likelihood that some payment default may occur when the securities have already been delivered (Committee on Payment and Settlement Systems, 1992).

### *2.2. A sociotechnical view of financial marketplaces*

There are a large number and wide range of research approaches and traditions that can be defined as sociotechnical (Bijker and Law, 1992; Bolton and Foxon; Latour, Mauguin and Teil, 1992; Mumford, 2006). Taking an actor-network informed sociotechnical view of financial markets proposes considering markets and marketplaces as forms of technological ‘black boxes’, that is, devices, practices, and organizations that are opaque to outsiders (MacKenzie, 2005). By ‘opening’ such black boxes it is possible to discover “how they are kept opaque; how they structure their ‘contexts’; and how those contexts are inscribed within them” (MacKenzie, 2005, p.555).

The development of a cross-border marketplace for securities presents an opportunity to study a financial market ‘in the making’ in order to understand better such processes of

financial marketplace black boxing. This is because it is at such moments of reconfiguration that black boxes are opened and that it is possible to gain an understanding of the way a marketplace is put together and how the reciprocal shaping of the social and technical entities involved in the process takes place.

By focusing on the empirical example of an attempted securities marketplace integration around the corporate and technological integration of national CSDs and the development of a common securities settlement information system, the study presented aims to observe how the ICT-based systems of such an initiative relate to the cultures, definitions, semantics, norms, regulations, and laws that will also shape the functioning of the cross-border capital markets of the future. This, in turn, has significant consequences in terms of illustrating how important choices with significant implications for the unfolding of financial globalisation are inscribed into these technologies, particularly in terms of the future positioning of both commercial and state entities in the emerging new global financial order (Fligstein, 1996; 2001; Winner, 1980).

In order to do this, the research seeks to answer the following overarching question: *How are the different sociotechnical elements of the proposed marketplace arrangement and their relations stabilised and what does this demonstrate about the role of ICTs in the establishment of a cross-border marketplace?*

## 3. Research design

A useful research tool for studying 'black boxing' proposed by Akrich and Latour is the notion of technological objects as non-verbal 'scripts' that assign actants roles through the enactment of which a technology is performed (Akrich, 1992; Akrich and Latour, 1992; Latour, 1996). As with a script for a play or film, a technological object (or, in the case of this article, an ICT system) can be seen as allocating roles, actions, and attributes to both the human and non-human elements of an ensemble of heterogeneous actants that underpin its

performance (Akrich, 1992). The success of a system then comes about when the ‘actors’ involved collectively ‘perform’ the ‘script’ inscribed in it by those who have developed it. Designers, therefore, *inscribe* their “vision of (or prediction about) the world in the technical content of the new object”, with the end product acting like a ‘script’ or ‘scenario’ (Akrich, 1992, p.208).

Taking such a research approach, the central focus of empirical enquiry is to “describe the specific role [all these] play within these networks” and the way in which “they build, maintain, and stabilise a structure of links between diverse actants” (Akrich, 1992, p.206). In this way the researcher can ‘de-script’ (Akrich, 1992; Akrich and Latour, 1992; Latour, 1996; Latour et al., 1992) the distribution of properties among these entities, the connections established between them, the circulation entailed, and the transformation of those attributions, distributions and connections during the development of the sociotechnical system (Latour, 1996).

Akrich identifies *controversies* as the key unit of analysis, seeing them as a way of finding the circumstances in which “the inside and outside of objects are not well matched” and which leads to disagreements, negotiations, and the potential for breakdowns that provide a good setting from which the mechanisms of adjustment among the various actors can then be described (Akrich, 1992, p.207). While Akrich acknowledges that with regard to every object there is a ‘consensual zone’, it is around points of friction in ‘controversial zones’, usually found around the margins, that “the battles leading to the establishment of supremacy of a certain design or solution are waged (Akrich, 1992, p.223).

One practical approach suggested in order to do this is to follow the negotiations between the designers of the new technological artefact and the potential users and study the way in which the results of such negotiations are “translated into technological form” (Akrich, 1992, p.208). In this way, how “technical objects and people are brought into being in a process of reciprocal definition in which objects are defined by subjects and subjects by objects” is revealed (Akrich, 1992, p.222). By focusing on the relationships and interactions between

actants and how these might succeed – or not – in stabilising and reproducing themselves rather than the properties of actants, potentially limiting and distorting reductionist assumptions can be avoided (Nicolini, 2013; Panourgias, Nandhakumar and Scarbrough, 2014; Tsoukas and Langley, 2010).

A central practical concern of such an approach is to identify the entities associated together by a particular conceptualisation of a technological object. The transformations that the proposed arrangement undergoes in order to associate more entities and gain in durability and acceptance is then traced. In this way, the different degrees of acceptance that successive versions of the proposed arrangement encounter, can be seen (Latour et al., 1992). This mapping allows the researcher to define a technological object as "a series of transformations – or translations – undergone by a collective of people and things" (Latour et al., 1992, p.34). Once a cluster of actants "stay together through successive versions", they can be "aggregated into a black-box" that is then given its own name (Latour et al., 1992, p.41).

### *3.1. Research setting*

The empirical research setting studied was a pioneering securities marketplace integration initiative by Euroclear, a corporate entity formed out of the merger of international central securities depository (ICSD) Euroclear Bank, and the securities settlement system operators of France (2001), Holland (2002), the UK and Ireland[2] (2002), and Belgium (2006). The resulting consolidated group reflected the ownership structure of its constituent entities that took the form, primarily, of cooperatives owned by the market participants and reflecting their usage of the constituent settlement systems. In turn, the relative waiting of each constituent

[2] Irish securities are also settled through the UK settlement system

marketplace determined the proportion of the new consolidated entity that market participants from the constituent entities would hold.

In 2008 Euroclear went on to acquire the Nordic Central Securities Depository (NCSD) from Nordic banks Nordea, SEB, Svenska Handelsbanken and Swedbank. As a result, the CSDs of Finland and Sweden now operate as Euroclear Finland and Euroclear Sweden, respectively (Finextra, 2008). Euroclear also owns EMXCo, a provider of investment-fund order routing, and also offers commercial collateral management services, third-party securities lending services and dedicated fund services to both the buy and sell sides of fund distribution (Euroclear, 2013). Although 86%-owned by its users, Euroclear operates as a 'for profit' entity (Euroclear, 2013). The consolidated group in 2013 covered over 65% of European blue-chip equities and 50% of European domestic debt outstanding and had a turnover of €573.8 trillion from 170.4 million transactions (Euroclear, 2013). The Euroclear CSDs held securities worth €24.2 trillion (Euroclear, 2013).

Applying the research approach outlined in the previous section to the initiative to integrate the securities marketplaces of France, Holland, UK and Ireland, and Belgium, through the process of developing a common cross-border securities settlement platform, it can be analysed as a technological 'script' for a new marketplace being proposed by the system developers to an expanded set of market actants. This script then goes through a series of rewrites, modifications, translations, and materialisations before the intended performance can be realised. During the processes of modification and translation that must precede any stable sociotechnical configuration, the roles proposed in the design go through a number of changes as ways of accommodating the interests and goals of the many actants and their requirements, particularities, and competences are taken into account. The new system will hold together and be performed if all the entities involved accept - and are able to perform - the roles the proposed configuration seeks to ascribe to them.

In order to arrive at this point, different conceptualisations and configurations of the roles of the entities that will constitute it are proposed, refined, tried, and translated until a viable

arrangement is arrived at. Only when all the entities assume their proposed roles and are able to perform them collectively and in a trouble-free way will the cross-marketplace and cross-border transfer of legal title to securities become a reality.

To study this, the focus of analysis in the research design adopted is on tracing the controversies involved in the development of this system among the designers and developers of the system and the actants to be assembled around the roles proposed for them in the new integrated settlement system. As this process unfolds, it moves from conceptualisation, to the drafting of business plans, the merger of corporate entities, consultations with market participants, and the development of ICTs. As this happens, the changes to the inventory and roles of the actants to be brought together was traced and particular controversies relating specifically to ITC components of the sociotechnical network being assembled were focused on as well as the choices made to resolve these controversies and bring about a stabilisation of roles and relationships.

In order to undertake this tracing of controversies in practice and in a way that helps answer the main research question of the study, the following questions are used to guide the analysis of the empirical material collected:

1. *What are the key sociotechnical controversies around the development of a cross-border securities settlement system and how are key actants positioned in relation to them?*
2. *How do these controversies and the relations of the actants involved in them evolve through the various design iterations until some settled state is reached?*

### *3.2. Data collection*

The main body of empirical material collected and analysed consisted of consultative and other project-related documentation assembled during the course of the design and development of the cross-border settlement platform[3]. This included a number of technical manuals and terms and conditions documents; third-party responses to public consultation processes relating to the development of the new system, and minutes and reports from Market Advisory Committees (MACs) a forum established for the representation of the interests of market participants in the particular national marketplaces to be integrated.

Another substantial body of empirical material was archival documentary material relating to the existing settlement systems, (e.g. operations manuals, terms and conditions documents, newsletters, statutes, public policy and commercial reports)[4].

Apart from the above documentary material, a number of interviews and ad hoc informal communications with people from both the settlement platform development side and market participants were also undertaken, as shown in Table 1.

| Actant | Roles | Interviewee | Number of Interviews and Duration | In-text Reference |
|---|---|---|---|---|
| Central bank | Market supervision; public policy making; Inter-bank payment system operator | Former director (overview of market infrastructures) | 2 interviews; approx. 1h45min each | Interview A1<br>Interview A2 |
| Market Advisory Committee | Market participant representation | Chairman of UK committee | 2 interviews; 40min and 1h | Interview B1<br>Interview B2 |
| Market Advisory Committee | Market participant representation | Member of cross-market committee | 1 interview; 20min | Interview C |
| CSD | Settlement system operator; settlement system design and development | Director of Business Model and Harmonisation | 3 interviews; approx. 2h each | Interview D1<br>Interview D2<br>Interview D3 |

[3] (see Appendix A and in-text citations and references)

[4] (see in-text citations and references)

| | | | | |
|---|---|---|---|---|
| CSD | Settlement system operator; settlement system design and development | Director of Strategy and Public Affairs | 1 interview; 40mins | Interview E |
| CSD | Settlement system operator; settlement system design and development | Head of Standards and Communication | 2 interviews; approx. 2h each | Interview F1<br>Interview F2 |
| Financial Services Provider | Market participant; global custodian; CSD shareholder; Financial advisor to Exchange owner/operator | Head of Global Custody | 2 interviews; 40min and 45min | Interview G1<br>Interview G2 |
| Financial Services Provider | Settlement bank services; Company Registrar services; Market participant; CSD shareholder | Head of Settlement Bank operations | 1 interview; 40min | Interview H |
| Large multinational corporation | Market participant (issuer; investor); | Senior Corporate Treasury manager | 3 interviews | Interview I1<br>Interview I2<br>Interview I3 |

**Table 1: Interviews undertaken**

The researcher also participated in workshops organised by Euroclear for market participants ahead of moves to the new integrated system from which notes, documents and presentational material used in the workshops were also collected and utilised. Finally, a number of press releases, articles from the press and other media reports also formed part of the empirical material studied and analysed.

The project documentation was chose as a central focus of the research in its design because it circulated across organisational and practice boundaries (Star and Griesemer, 1989) and also represented an unambiguous, public, and easy to follow trace of the developing associations that would eventually form the new marketplace.

By law, this documentation was public and freely available as settlement system operators are obliged to consult with market participants whenever any new functionality the use of which will not be optional is introduced. The way the documentation worked in this capacity can be understood from the following explanations regarding the aims of consultation and other project-related documentation provided by Euroclear:

*"Consultation papers are dynamic papers, typically one per programme, which are regularly updated with outcomes of feasibility analysis, market consultation input, etc. (…) Working papers are interim or ad-hoc papers used for work in progress when required. They cover specific items that, once finalised, will be included in the consultation papers. In addition to direct communication with clients, consultation is also formally conducted through the Market Advisory Committees". (Euroclear, 2003, pp. 11-12).*

The documents and texts involved in the design and development of the new settlement system, therefore, provided a trace of the process of public writing and re-writing, commenting, modification, and attempts to identify common ground and key sticking points and points of controversy among the proposed script and the actants to be enrolled and assembled by it.

### *3.3. Data analysis*

As can be seen from the above, the role of the technical and other project-related documentation accompanying the development of the Euroclear single settlement platform was not only a way of relaying information between the system designers and operators and potential users, but also a means to bring together and link the participants in the overall endeavour of designing and developing such a marketplace mechanism. Seen in this way, documents are, as Preda suggests, "organizational devices, with the help of which relationships are created, maintained, and managed across various contexts" (Preda, 2002, p.208), or as Cooren proposes in relation to texts such as reports, contracts, memos, and work orders, participating in the stabilization and repeatability of organisational activities over time (Cooren, 2004). The consultative and other project-related documents, therefore were

not analysed primarily in terms of their content, but for the way in which they build a world of their own through the establishment of associations between actants, thus avoiding the pitfalls of *interpretation* (Latour, 1996).

In practical terms, this made it possible to identify and outline particular controversies relating to specific proposed aspects of the system under development in the following ways: Key controversies (and their elements) were identified through the increases in document generation relating to particular consultative iterations. Once the relevant documents were identified in this way, by comparing versions of these consultative documenters it was possible to see which the key contentious passages were and how the sociotechnical associations they proposed changed from one iteration to the next, until resolution and stabilisation could be achieved and the resulting association could then progress from proposal to specification. Investigative attention then focused on key controversies thus identified through interviews, informal contacts and conversations, recourse to legal texts and statutes, and so on. In this way, relevant actants involved in some particularly interesting type of sociotechnical association could be identified and if necessary further evidence relevant to their involvement collected.

In general, throughout the project, this controversy-centric analysis was particularly useful as a guide to follow-up data collection in terms of verbal and email clarifications to be sought, identification of relevant media coverage to be collected, and developing specific lines of questioning for the formal and extensive interviews undertaken.

Information about which issues were problematic and which uncontroversial, what external influences might have come into play, how these were understood and then incorporated into the logic of the document assembled, and what sources were used was gained in this way. Similarly, information about what approval processes specific claims in a document went through, what kind of feedback was received, and how these related to the emergence of the next version of the document in question were also collected. In this way issues could then be followed to a next iteration of the development process, whether this was in the form

of an updated consultation document or a service description document that could then act as an input to the programmers and other technical experts involved in the assembling of the ICT platform.

## 4. Empirical account and analysis

The starting point for the initiative studied can be traced back to 2000, when Euroclear, the central securities depository for Eurobonds and other international securities based in Brussels (Norman, 2007), embarked on a strategy of mergers with a number of central securities depositories (CSDs) in Europe. The aim was to take advantage of the future business opportunities expected to flow from moves to establish a single market for financial services in the EU and the growing demand for derivatives linking together different financial instruments and asset classes.

The integration initiative started with the merger between Euroclear and Sicovam SA, the French CSD and settlement system operator in January 2001, then Necigef, the Dutch CSD in February 2002, and CRESTCo, the UK CSD and settlement system operator in September 2002. Finally, CIK, the Belgian CSD, was acquired fully from Euronext, the company that owned the Paris, Brussels, Amsterdam, and Lisbon stock exchanges on 1 January 2006 (Euroclear, 2005). Euroclear SA/NV became the parent company of both the national CSDs and of the Euroclear Bank ICSD with the aim of integrating these disparate ICT securities settlement platforms into a Single Platform that would operate across borders, jurisdictions, and marketplaces.

The objective of the integration initiative can be summed-up by the phrase: "*Delivering a domestic market for Europe*". This phrase was used by Euroclear as the title for the first public document on its plans for developing a cross-border settlement system for securities that was published in July 2002 and which states:

*"We intend to cut away the current costs and complexity of cross-border settlement by removing the borders. We intend to create a single domestic settlement space covering the five countries in the New Group – Belgium, France, Ireland, the Netherlands, and the United Kingdom." (Euroclear, 2002, p.5)*

The first major element of the new settlement system to be developed would be the Single Settlement Engine (SSE), that, by providing the existing separate national settlement systems with a shared core functionality would bridge the separate existing individual securities marketplaces to be integrated, realising in the process substantial network effects and economies of scale.

The SSE would replace the existing core settlement processor systems of the constituent CSDs while leaving other components of their legacy systems largely in place (see Fig.2). Once completed, the SSE would be in a position to deliver settlement of cross-border transactions across the various group entities on an *internal book-entry basis*. This meant that users would be able to access any securities they hold with any CSD in the consolidated entity through a single umbrella account with sub accounts, allowing transfers across these accounts to be treated as *internal transfers*, eliminating any external costs and transforming them into simple book-entry transfers as would be the case with a domestic trade.

The Euroclear developers saw the SSE as important in terms of dealing with the complexity of the various systems. The scope and complexity of the initial integration would be reduced as market participants would interact with the SSE through their existing interfaces with the local CSD settlement platforms using the existing messaging and reporting functions and contractual agreements, with each set of securities held in the local CSDs remaining subject to local asset protection and transfer legislation (Euroclear, 2003).

The relationship between the CSDs and the operator of the SSE was to be structured as a "contract for the provision of services", whereby each of the constituent CSDs will outsource

parts of its IT processing to the SSE operator and would be similar to third party outsourcing arrangements for IT services already in place on the side of the local CSDs (Euroclear, 2003, p.17).

The SSE came into operation with the French CSD on 29 May 2006 and the UK CSD on 28 August 2006 and with the Euroclear Bank ICSD at the end of 2006. During a second phase, a complete consolidation of all constituent CSD platforms and systems was envisaged (see Fig 2), providing access to the new shared platform over a common interface for all users of the consolidated Euroclear group, irrespective of jurisdiction (CRESTCo, 2004). Upon completion of migration to this new Single Platform users would have the possibility of accessing all securities settled through the combined system "through one securities account, with one interface, one payment relationship", but "with a choice of service levels and tariffs" (Euroclear, 2002, p.8).

[Figure 2 here]

An important intermediate step towards the creation of a single cross-border transaction-processing platform was to offer a harmonised settlement platform for the straight-through processing of trades from the Euronext[5] single integrated order book at the centre of the consolidation of the Paris, Brussels, and Amsterdam stock exchanges. The Euroclear Settlement of Euronext-zone Securities (ESES) system would provide the Euronext-zone market CSDs (Euroclear Belgium, Euroclear France and Euroclear Nederland) with an integrated settlement system and harmonised custody service for both stock exchange and over-the-counter transactions. Euronext market participants would thus have a single access point of their choice to settle trades conducted on any of the Amsterdam, Brussels and Paris

[5] The single corporate entity formed out of the merger of the Paris, Brussels, Amsterdam, and Lisbon stock exchanges and London futures exchange LIFFE.

segments of the Euronext exchanges (Euroclear, 2004). The ESES would replace the existing settlement platforms in France, the Netherlands, and Belgium with a modified version of the Euroclear France Relit à Grande Vitesse (RGV) platform but that for settlement processing would now have the SSE at its heart.

### *4.1. The key controversies*

This section describes the key controversies identified in the study, the positions of the actants involved in them, and the evolution of both during the unfolding of the integration initiative.

**Benefits and their distribution**

One major controversy emerged out of the way the benefits and gains from market integration, both in terms of fees generated from a much greater pool of users and transactions but also economies of scale and efficiencies would be distributed across the marketplace and among market participants.

It was anticipated by Euroclear that cross-border transaction costs could be reduced "by up to 90%" bringing them down to the "levels prevailing in domestic markets" and giving users the opportunity to "access directly a single operational securities account, on a single platform, spanning domestic securities markets" (Euroclear, 2007, p.1).

The anticipated cost savings envisaged from this initiative are presented in Table 2 that follows.

| Cost savings | Sources of savings |
|---|---|
| Tariffs | Replacement of expensive cross-border CSD charges by domestic charges for market participants |
| Back office | Standardisation of back-office procedures for market participants across five previously separate sub-units.<br>Reduction of interfaces to settlement platforms with different technical specifications, messaging arrangements and operating practices. |
| Infrastructure | Consolidation of IT systems and avoidance of duplicate investments at the |

| | |
|---|---|
| investment | European level (e.g. two data centres instead of eight, fewer inter-CSD links to manage and maintain, lower development costs due to increased purchasing power vis-a-vis IT suppliers, rationalisation of support functions and back-up arrangements, reduced number of systems upgrades). |
| Risk reduction | Reductions in the credit risk resulting from timing differences between the settlement process in a local market and the delivery of the securities to another local CSD.<br>Reductions in the operational risk involved in multiple and often complex and unwieldy interfaces between separate marketplaces. |
| Working capital | More efficient use of collateral resulting from the avoidance of fragmentation across separate settlement systems |

**Table 2: Anticipated cost savings from integration initiative**

There were concerns, particularly among UK market participants, about how the new integrated system might become a monopolistic cash-cow or provide certain market participants with more benefits than others. For example, custodians[6] with large proportions of their market share in cross-border business in the marketplaces being integrated were hostile to the initiative because it would deprive them of a large chunk of their custody business revenues. Furthermore, it provided other custodians with cross-border business beyond the markets to be integrated (e.g. serving clients with a large proportion of North America to Europe cross-marketplace transactional needs) with a very cost-effective solution for offering their clients low-cost but high-value access to a large European pool of liquid.

Questions around the distribution of benefits from the proposed new system also related to how the ICSD component of the Euroclear group would gain a potentially unfair competitive

[6] Custodians are financial service providers that provide safekeeping and transaction management for securities and other financial assets on behalf of clients. They are able, through networks of local subsidiaries and agents, to buy, sell, and hold securities for their clients outside the home jurisdiction of these clients, while conveying the benefits of this ownership to them in their home jurisdiction. The clients, however are only the 'beneficial', not outright owners of the securities without the full range of property rights that outright ownership would confer (Schwarcz and Benjamin, 2002).

advantage vis-a-vis other ICSDs (e.g. Clearstream, SIX SIS) as a result of lower costs from economies of scale, much larger revenues, and control of a strategic location in the emerging global financial services marketplace.

Finally, there was also disquiet about the benefits that may be conferred to particular stock exchange operators as competition and consolidation in that market increased, particularly in Europe, with the Euronext grouping bringing together the Paris, Brussels, Amsterdam, and Lisbon stock exchanges seen as potentially gaining in terms of what was seen by some as the subsidisation of the development of a crucial market infrastructure for their markets vis-à-vis other exchanges (e.g. Deutsche Boerse group, LSE, Milan Burse) that would have to develop their own cross-border post-trade infrastructure if they sought to expand through mergers with, or acquisitions of, other exchanges in Europe.

**Ownership and governance**

A controversy that overlapped with the one around the distribution of benefits from the integration revolved around the ownership and governance of the new entity. Again, it was primarily UK-based market participants that voiced concerns in relation to the potential loss of the influence they enjoyed in the running of UK CSD CRESTCo where market participants owned the company and shareholdings reflected their use of the system, with rebalancing of shareholdings at regular intervals and the return of profits to the users via fee reductions.

With the new cross-border entity, in the first instance the shareholdings in the combined concern of the various constituent entities reflected the relative ‘weight’ in the combined system of each individual CSD in terms of system usage. These would then be distributed to the members/users of the individual constituent CSDs according to the arrangements and shareholdings prevalent at the individual local CSDs.

While there would be no formal shareholder re-balancing mechanism for the combined entity, as was the case with CRESTCo in the UK where shareholdings would be periodically

altered to reflect changing levels of usage of the system by a particular user or user group, there was only a vague commitment from Euroclear “over time to enable shareholders to increase their shareholdings where that is justified by their usage” and to enable “users who are not shareholders to acquire shares” (Euroclear, 2002, p.38). There was, however, no requirement for a holder of Euroclear shares to be a user of the Euroclear systems (unlike the comparable provision in the CRESTCo). Furthermore, it was in the discretion of Euroclear directors to refuse to transfers Euroclear shares if they so wished.

There was also no formal mechanism proposed for the distribution of profits in a way that balanced returns to shareholders with rebates and fee reductions to the market as a whole and investment in the settlement platform. It was simply suggested that there should be a distribution of dividends “at least equal to 60% of the first 15% of return on equity”, with the Board of Euroclear deciding on an annual basis “the distribution of the financial surplus” in terms of retained earnings, fee rebates for customers, and dividends to shareholders (Euroclear, 2002, p.33). The composition of the Board itself would “reflect the geographical and sectoral spread of the combined group’s users” and would also include two independent directors “not associated with any user firm” (Euroclear, 2002, p.36).

Instead, Euroclear proposed the formal institution of Market Advisory Committees as a way of ensuring responsiveness towards the interests of market participants. Already part of the French settlement system, Market Advisory Committees (MACs) would now be introduced to the other domestic markets and strengthened by being given a formal status with defined rights and responsibilities. Although these MACs would “not replace the Boards of Euroclear Plc or Euroclear Bank as the decision making bodies of these companies”, their influence would, according to Euroclear, be significant as they would have the right to address directly the Chairman and the Board if they consider that it is necessary (Euroclear, 2002, p.37). Membership of the Market Advisory Committees, however, was vague, with wording along the lines that it would be “widely drawn” and include the principal sectors relevant to each

individual market, with representation from the retail sector, institutional brokers, custodians, market makers, registrars/receiving agents and the gilts market (Euroclear, 2002, p.37).

**Internal book-entry transfer**

One of the key functions of any securities settlement system is Delivery versus Payment (DvP) (Committee on Payment and Settlement Systems, 1992; Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions, 2001). DvP is achieved in an incontestable way when "payment finality coincides with final transfer of securities [ownership] enforceable against third parties" (Euroclear, 2003, p.20). How to accomplish DvP across borders in a way that would hold across all five of the marketplaces to be integrated was, therefore, another controversy facing the developers.

While at the technical level cross-border DvP appeared to be a straightforward database integration task involving primarily the assembling of technological entities, when the legal and regulatory aspects were taken into account, it became much more complex and went to the heart of how jurisdiction is defined. In order to better illustrate this, it is useful to examine the way legal title to ownership was transferred in CREST, the UK's legacy settlement system.

In the UK system, there were two separate IT sub-systems: the *Settlement Processor* that executes the system's settlement algorithm and the *Operator Register*, the database in which legal title to a security is assigned to an owner. In this arrangement, a securities title entry in a CREST participant's *Stock Account* was considered as proof of legal ownership of the title. This is because the database in CREST acts as the *Operator Register* foreseen in the relevant UK legislation as the official record conferring legal ownership of a security. With the introduction of the SSE, the *Settlement Processor* used by CREST would be located outside the CREST platform, but also outside the borders of the UK. A legal requirement for

the *Operator Register* to be in the UK still remained, however, as, according to UK company law, a company incorporated in the UK must have its shares register in the UK.

In order to be able to maintain the full range of property rights that define securities as objects of exchange, the designers of the new cross-border settlement system had to somehow preserve the link of the securities with the jurisdictions that define them, while finding a way of disentangling their actual settlement process from that same jurisdictional space.

To meet this requirement in practice meant there had to be a securities holdings database located in the UK even if settlement itself took place in the SSE outside UK jurisdiction. Transfer of legal title would then be constituted by movements of entries on the local database and, in the event of a discrepancy the records of that local database would prevail.

The solution the developers came up with was that the SSE database would hold *copies* of the local records for processing, reconciliation and audit purposes but these records would be *mirror records* of those in the particular national jurisdiction (see Fig.3). As, however, the finality of the transfer of the cash and the finality of the transfer of the securities needed to occur simultaneously to meet the requirements of DvP models with immediate finality (Committee on Payment and Settlement Systems; 1995; Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions, 2001), the generation of the updated cash records of the transacting parties would be made *conditional* upon the generation of the securities records on the *local* Legal Record database. As DvP takes place with the update of the *Legal Record*, the jurisdictional requirements for the securities being transacted are thus fulfilled.

[Figure 3 here]

A key element in this solution was the use of ‘omnibus accounts’ to overcome the need to create an account for every possible transacting party in every existing local CSDs. Originally, omnibus accounts were shared settlement accounts holding the commingled positions of multiple transacting parties which large settlement system participants often maintained at the CSD for their clients and which they maintained themselves in terms of account records. The SSE used the concept of omnibus accounts so that instead of the movement of the securities having to take place directly between the accounts of the two transacting parties in one of the two *local* Legal Record databases, it takes place between the account of the seller and the omnibus account of the CSD of the *buyer’s* jurisdiction in the jurisdiction of the *seller*. The local Legal Record database of the *seller’s* marketplace then sends a message to the local Legal Record of the *buyer’s* marketplace that updates its own legal records, reflecting the movement of the securities being acquired from the omnibus account of the buyer’s CSD at the ‘home’ CSD of the seller to the account of the buyer in the buyer’s CSD. Then, following update of its records, the Local Record of holding of the buyer’s market sends a confirmation message back to the SSE that then updates its cash and securities records, releases the securities and cash for re-use and starts processing the next transaction. Consequently, settlement between customers of the two still separate legacy systems achieve DvP and the cash and securities received in settlement are available to the transacting parties simultaneously, immediately upon the completion of the updates to the SSE.

Previous to the transactional linkages described above, it was not uncommon for delays of several hours to occur for confirmations of settlement to be passed between two separate CSDs and during this time the cash or securities involved would be unavailable to one or both of the transacting parties because even when one counterparty had exchanged securities for cash, the counterparty in the other CSD would be unable to get access to the countervalue until the confirmation had been processed by both CSDs.

**Common data structures**

A key technical component in making possible these transactional linkages was the negotiation and development of a specially formulated set of electronic messages for communication between the databases of the legacy settlement platforms and those of the SSE. The team developing the SSE used the CREST Data Exchange Messages (DEXs) as the basis for the SSE DEXs that contained all of the information and messages that the SSE needed to function (Interview F1). The new message set includes messages for sending transactions, messages to record transactions, to change the priority of the transactions, to access reference data (e.g. securities reference data, credit reference, account structure data). The person responsible for ISO Message Standards at Euroclear explains the importance of the electronic messaging to the functioning of the SSE and the issues that emerged around electronic messaging in the following quote:

> *"We knew [messaging] was absolutely critical. (...) You need to know the structure of the accounts and who owns what; that all has to go on, on a daily basis. There are diary events, when a settlement window opens and when it closes. That information has to go down to the SSE. There is information about technical netting (…). There [are] all sorts. Obviously the CSDs (…) due to make changes were able to challenge and say: "we can't do that, can we do it this way", but essentially it was down to the core SSE to define the single interface to it and it was up to the CSD projects to connect [to] it in that way. (…) There was a significant amount of technical work there. It is a good 300-400 page document. It is not insignificant. (…) CREST hitherto hadn't had a distributed database. It had a big single database that it could completely control. All of a sudden it had its own local database and the SSE database and having this split in the database and asynchronous updates, sometimes here and sometimes there, that [brought up] a whole new set of issues." (Interview F1)*

The controversies here were primarily among the existing local settlement system technical teams and the SSE development team, but even this apparently technical matter of mapping data structures through electronic messaging got entangled with wider political, legal, and tax issues as was highlighted by the chairman of the UK-MAC commenting on the issue of the investor ID field that was necessary in the Dutch settlement system.

> *"The Dutch have a field in their information exchange when they are matching transactions, which identifies the beneficial owner in the transaction, whereas in the UK we do not do that. You do not have the field. (…) The Dutch say they must have that [for legal reasons] and they also think it would give better straight through processing because you know who [the transacting parties] are so if anything goes wrong, you know there is traceability and all that. The British, in particular, said: 'this is hopeless because a lot of us have nominee accounts which are aggregated and have lots and lots of people in them'." (Interview B1)*

Because the need for an investor ID is so embedded in the Dutch legal and tax systems, it would be very difficult to deal with this controversy through legal means that may have required significant parliamentary-based legislative changes. At the same time, the possibility of anonymity offered by nominee accounts in the UK is a major attraction of London as a venue for securities trading and deeply embedded in the structures of the marketplace.

In the end, the controversy was resolved through a technological work-around. For Dutch securities traded on the Dutch stock exchange, regardless of where the trader is, the investor ID field would be filled and would thus have to be available throughout the new system. Anybody trading outside the Netherlands, however, would not be obliged to fill the

field. As the chairman of the UK MAC pointed out, “some people have the boxes and want to do it; optionally, you can do it, but you don't *have* to”.

**Withholding tax**

Another controversy which was similar to the one about the investor ID field as it crossed from the technical integration work into the fiscal regime of one of the local marketplaces was the interfacing between the proposed settlement system and the French tax system and related to the arrangements for withholding tax in France. A member of the cross-market advisory committee (XMAC) described this controversy as follows:

> *“One of the most controversial [issues] was French withholding tax. Under French law, you must have a fiscal agent who is responsible for collecting resulting tax before payments are made to investors. (…) It had the effect of requiring every remote user of the French market to have to appoint a French-based competitor to do that fiscal agent job for them and they said: "This is not a [level] playing field; we don't want to do that. You French have got to change the law so that a remote user can be free of having to use a competitor as a fiscal agent". (Interview C)*

A first solution proposed was for the issuer of the securities in the French marketplace rather than a settlement system participant to account for withholding tax on dividends to remote holders. Another was for Euroclear France to account for withholding tax on remote account holders. This quickly became the preferred option. It required, however, significant changes to arrangements such as record dates (the date on which the shareholders entitled to a dividend are recorded) and ex-dividend dates (the cut-off date for recording the shareholders entitled to receive dividends). The French authorities, therefore, had to agree to implement “a two-day gap between the ex [dividend] date and the record date by 2007”, so as to make

the solution workable (Interview C). This took the form of a proposal to amend the French Income Tax Code (Interview C) in a way that would allow non-French account holders of Euroclear France to act as French withholding agents with respect to income from French securities held in Euroclear France, and which saw the French government passing the necessary changes in a Finance Law adopted at the end of 2006.

The law would allow non-French financial institutions to act as withholding agents after entering into an agreement with the French tax authorities to take on a new role of 'remote account holders'. These Remote Account Holders would then be allowed to deduct and remit French withholding taxes on income from French securities held with Euroclear France. Two groups that were crucial to the successful adoption of this solution were the French securities issuers (ANSA)[7] and the French paying agents (AFTI)[8] who defined the new 'remote account holders' role through consultations with non-French entities interested in providing it and the developing of mandate agreement templates (Interview C).

The 'remote withholding agents' would also have to enter into agreements with the French tax authorities that would specify requirements regarding documentation, reporting, withholding and deposit obligations, auditing, penalties for non-compliance, and how to deal with defaults (Interview C).

**Settlement algorithm**

In order for the new settlement system to process the much larger volume of transactions that the integrated marketplace would result in, it was also important to ensure the speed, efficiency, and resilience of the processing of transactions. While these gains would be partly

[7] ANSA is the French securities issuers' association, or "Association Nationale des Sociétés par Actions.

[8] AFTI is the French Association of Securities Professionals (Association Française des Professionnels des Titres), which represents participants in the 'post-trade' sector of the securities industry in the French marketplace and within the European Union

realised through improvements due to the much more advanced computer hardware that would be used, a new common settlement algorithm that determines the sequence in which available resources are allocated to the transactions received for settlement was also to be developed for this reason for the SSE.

Another controversy developed around the implications that this change might have. The nature of the controversy here related, not to a questioning of the anticipated improved efficiency of the new system in terms of throughput of transactions or reduced failed trades, but on how the allocation of failed trades might be affected. This was a concern for the market participants, both on the trading side but also on the settlement bank service providers side because failed transactions can become a source of often costly and acrimonious market disputes and also result in fines for recurring failures levied by the CSD and market regulators. Furthermore, because of the borrowing and lending of securities and the extent to which this had become a much more intense and extensive practice as part of aggressive trading strategies such as ‘shorting’, there was significant concern among the post-trade experts of market participants regarding a) how this would play-out in the marketplace once the new settlement algorithm was introduced, and b) the impossibility of testing what might happen ahead of the introduction of the new algorithm.

The adoption of a common new algorithm across the different CSDs implied certain changes in the precise ordering of transactions for settlement. In the UK’s CREST system, for example, the availability of transactional resources (e.g. relevant securities, sufficient liquidity in the buyer’s settlement bank account and in the buyer’s settlement bank’s account at the central bank) were considered in parallel. If the resource being considered were insufficient to settle the transaction, further resources were not examined and a failure was generated for that particular settlement attempt for the transaction in question. In the SSE the checking of the availability of the necessary resources was performed in sequence.

A senior member of the Business Model and Harmonisation team at Euroclear involved in the development of the SSE explained this as follows:

*"The one thing we did have to harmonise [with the SSE] was the exact mechanics of settlement. So, for example, CREST used to use a parallel set of processes. We would have the securities queues, the stock queues, the cash queues, and it would have a lot of parallel processing and each type of resource would have its own rules about the order in which they would be tried (…) so there were a number of things going on in parallel. The way liquidity was prioritised was different to the way securities stocks usage was prioritised. CREST had the mini cycles that took advantage of that. But the SSE was designed along the lines that Euroclear Bank used at the time, which was to have a monolithic … single threaded process running on a very fast machine and everything loaded into memory. So it was very fast. No disk access (..). It would flash through this threaded process, this single queue of transactions; very very fast. (…) So it is a very different approach." (Interview F2)*

Furthermore, the new algorithm would also incorporate a number of optimisation tools aimed at reducing transaction failures by analysing groups of transactions as a whole with the aim of "increasing settlement efficiency in general' and "minimising risk and credit usage" (CRESTCo, 2006, p.21). Rather than using a repeating cycle of settlement, where all resources were allocated in parallel and then followed by a period of settlement during which any transaction for which all resources were present would be settled (e.g. the existing CREST system in the UK), the new settlement algorithm would work instead on the basis of attempting to settle each transaction through a "dynamic recycling of failed transfers" (Interview F2). The same Euroclear interviewee as above, talking about this aspect of the SSE, said:

*"There is this thing in CREST called 'circles', which is where we try and resolve settlement failures at a certain point in the day. We say, that for every transaction that's currently outstanding and could settle but hasn't, we look at those in a sort of macro view and we see that if we net some of them off we can do the positioning in a netted way, but still settle gross. It's not a netted settlement, but it's a netted positioning. And each market had a very different approach to how this was done. For example, Euroclear Bank, when it found any of these failures, as it found a failure it would very quickly, for that particular failure, go and look and see if there was something that was similar, going the other way." (Interview F2)*

Two mechanisms were built into the SSE for dealing with failing instructions: 'Recycling' and 'Technical Netting'. Recycling tried to reposition in the settlement sequence a previously failed instruction in the hope that the repositioning would enable the transaction to settle because, for example, missing cash may have become available in the buyer's account through the sale of other securities earlier in the settlement sequence. With dynamic recycling the settlement process immediately retries one or more previously failed instructions when an event that might allow a new positioning attempt to be successful occurs. In this way, failed instructions would get automatically recycled throughout the day, pending the availability of the required resources[9]. With Technical Netting the algorithm analyses all failed transactions at the SSE and links these all together in an attempt to identify and suggest nets (i.e. transactions that may cancel each other out). The failed transactions are then sent to the SSE for positioning as *linked transactions*. If any of these transactions settle through this way, they are removed from the net. The remainder stay in the net and through their new relative positioning to each other, the algorithm will attempt to

[9] Recycling gives no guarantee that positioning will be successful. The decision to recycle only reflects that there has been a change since the last attempt, which may mean that another attempt might be successful.

settle them. If the ‘net’ fails to settle entirely, the process of identifying technical nets is resumed. The netting process will run at specified limited times during the day.

Because it became clear that there was no easy way to forecast, or somehow model or simulate, what these technical changes would mean in practice for the activities of participants and the allocation of failed transactions, the controversy around the implications of the new algorithm for market participants was left pending. Instead, through workshops with the back-office teams of the market participants and service providers, the Euroclear developers sought to familiarise them with the new arrangements and work out with them how various situations and scenarios might be handled and reassure them that due to the much more effective optimisation, the overall occurrence of transactional failures would be so reduced that this would outweigh any specific problems they might have to face with the allocation of fails.

**Cross-border payments**

In addition to the transfer of securities outlined in the section on internal book-entry transfer, arrangements had to be put in place for the payment side of cross-border transactions. In all the Euroclear legacy settlement systems, whether directly through accounts held at the central bank or through settlement banks with an account at the central bank, payments for securities transactions were effected through the use of central bank payment systems.

To enable transacting parties within one central bank regime to make payment to those in another without requiring cash correspondent relationships to be established, Euroclear worked with the central banks of the jurisdictions covered by the integrated system in order to develop a mechanism for coordinating the transfer of cash between these markets through cross-central bank transfers. The approach chosen was that each central bank would act as a correspondent of the other central bank for the purpose of making central bank payments from one jurisdiction to another.

Despite work on the technical level around the setting up of the arrangements outlined above between the SSE development team and the central banks of the jurisdictions that the new settlement system would span, the point of interface between the SSE and the Target (and later Target2) payments systems eventually became the most critical controversy regarding the integration initiative[10].

At the centre of this controversy were the different models for the mechanisms that link the settlement system with the central banks and their payment systems. Most such mechanisms can be fitted, more or less, into two broad categories.

One is the 'interfaced model' in which there is a separation of the securities settlement system operated by the CSD and the payments system operated by the central bank. This requires coordination between the two system operators in order to provide DvP, as the cash records are operated exclusively by the payment systems of the relevant central banks.

The other is the 'integrated model' where the processing of both securities book entries and cash book entries takes place on the securities settlement system. This requires legal arrangements between the CSD and the central bank to ensure that finality of payment can be achieved within the CSD.

Because the 'interfaced model' required "managing dependencies on several external systems which creates delays and additional risks in a cross-border environment" (Interview D3), in order to establish links between central banks, the SSE had been designed on the basis of the 'integrated model'. One of those involved in the design and development of the SSE explains the choice as follows:

> *"With the Banque de France system liquidity gets shoved over to the settlement system at the start of the day and settlement goes on, debits and credits, the account*

[10] TARGET and TARGET 2 are the inter-central bank payment systems developed for the Eurozone and operated by the European Central Bank following the launch of the Euro.

*is actually outsourced to the settlement system. Then, two or three times a day, the result is posted back to the Banque de France so liquidity can be made available for other systems. … The integrated model has the whole of the [central bank cash] account processed at the securities settlement system. So we looked at these two methods and we liked the Banque de France model more because it was more efficient. You have far less messaging between the central bank and the securities settlement system, therefore less can go wrong. You have the liquidity where you need it, which is on the [securities settlement system]. It is chundering through 600,000 transactions a day, market-wide, so that is where you need the information from the central bank." (Interview D3)*

This apparently technical decision came to be at the centre of an expanding controversy between Euroclear and the European Central Bank. A report from the cross-market market advisory committee, the XMAC, from November 2005 described the situation at the time as follows:

*"The decision of the … Governing Council of the European Central Bank (ECB) on whether to accept the model has again been deferred. Whilst it is known that some central banks [in the rest of the Eurozone] do not favour the proposed model, informal discussions have nonetheless been taking place at Governing Council level. A senior-level working group, comprised of payment systems' senior figures, has been formed to consider the way forward. The prolonged uncertainty about the future of the integrated model is unhelpful but Euroclear has no option but to continue, considering that the proposed model is within the scope of existing ECB policy and Euroclear has already undertaken two years of development based on this published policy position. The Harmonisation team continues to meet with European central banks to address*

*any issues, concerns or misconceptions that they might have about the integrated model." (Cross-border Market Advisory Committee, 2005, p.1)*

The controversy eventually became a full-scale conflict between two competing visions of how to integrate separate securities marketplaces and jurisdictions across Europe when the ECB announced on 7 July 2006 that it was "evaluating opportunities to provide settlement services for securities transactions" (European Central Bank, 2006). The ECB press release of that day is quoted in full below because it outlines the key dimensions of the controversy, gives the public reasons for the decision of the European Central Bank to launch the development of a pan-European settlement system that would, in effect, render the original Euroclear single platform initiative surplus to requirements.

*"Conscious of the need for further integration in market infrastructures, and extracting the benefits from the implementation of the TARGET2 payment system, the Eurosystem is evaluating opportunities to provide efficient settlement services for securities transactions in central bank money, leading to the processing of both securities and cash settlements on a single platform through common procedures. At its meeting on 6 July 2006, the Governing Council of the European Central Bank decided to further explore in cooperation with central securities depositories and other market participants, the setting up of a new service – which may be called TARGET2-Securities – for securities settlement in the euro area.*

*The objective of this project is to allow the harmonised settlement of securities transactions in euro which are settled in central bank money. Synergies for the market with other facilities operated by the Eurosystem will be sought, in particular in connection with the future TARGET2 payment system.*

*The implementation of such a facility, which would be fully owned and operated by the Eurosystem, would allow large cost savings as a result of the high level of technical harmonisation that this facility would entail for all market participants and would represent a major step towards a single Eurosystem interface with the market.*

*The Eurosystem will now consult central securities depositories and other market participants on the envisaged facility. A final decision on this project is expected by early 2007."(European Central Bank, 2006)*

Discussing the reasons for the rift with the ECB, the same interviewee who described the design decision to opt for the integrated payments mechanism for the SSE pointed to concerns about the movement of large amount of cash liquidity in and out of the ECB inter-central bank payment system as a major reason for this development:

*"The real issue (…) was really about how to use [cash] liquidity once it has been moved from A [Target 2] to B [SSE] (…) and may well have been one of the contributing factors to the whole TARGET2-Securities proposal. (…) We thought we would go for the integrated model because that was more efficient. That created a lot of ructions in the ECB where they essentially didn't agree with us that the integrated model was the most efficient way, and that began all the stuff that I am not going to go into." (Interview D3)*

The development of TARGET2-Securities (T2S) proposed in the above press release by the ECB would almost certainly mean that much of the investment into developing the Single Platform from Euroclear could be rendered obsolete. Not only the actuality, but even the potentiality, of T2S would be enough to increase the uncertainty of the investment to a

degree that it would become unpalatable for many Euroclear shareholders and system participants to back it.

### *4.2. Analysis of the controversies*

In line with the two secondary research questions informing the analysis of the empirical material, Table 3 below summarises the key controversies identified and described in the previous section, their interrelations, and how these unfolded over time.

| Controversy | Key actants | Evolution/Outcome | Related Controversies |
|---|---|---|---|
| 1. Definition and distribution of integration benefits | Euroclear management; Euroclear shareholders, Traders/dealers, Custodians, Registrars | Even up to the launch of the SSE, this controversy persisted around doubts regarding the extent of market-wide cost and efficiency gains and who they would accrue to. Custodians who saw a threat to their business became a vocal and public opposition that also included market participants concerned at a possible non-user owned for-profit system that would 'privatise' the market-wide benefits that might result. Eventually became entangled with the controversy around the interfacing with Targe2 and the ECBs T2S proposal with those concerned about the Euroclear approach supporting the ECB proposal and their lobbying seen as having prompted the greater interest of the ECB in the issue. | 2,3, 4, 6 |
| 2. Ownership and governance | Euroclear management; Euroclear shareholders, Traders/dealers, Custodians, Registrars, Settlement banks, Exchange owners/operators | Euroclear sought to allay market participants' fears of a possible non-user owned/controlled for-profit system or one that would not reflect the balance of interests of the different market constituencies by giving greater prominence to the role of the MACs and their ability to take grievances to the Euroclear board. Concerns persisted however because the board could ignore the representations of the MACs if it so chose and non-users could become shareholder of the new entity operating the system. Eventually got subsumed in the wider controversy around the ECBs T2S proposal. | 1, 3, 6 |
| 3. Competition between exchanges, financial centres, and ICSDs | Exchange owners/operators, Shareholders in Exchange operators, EU regulators, National governments | Controversy persisted and also became entangled in the wider controversy around the ECBs T2S proposal, with rival exchanges to Euronext seeing the Euroclear initiative as providing a key post-trade functionality for Euronext at no expense. In addition, the ability of Euroclear Bank to offer such low-cost cross-border access to such an expanded liquidity pool was seen as unfair competition to rival ICSDs such as Clearstream. EU competition commission concerns and lobbying of rival exchanges and ICSDs together | 1,2, 4, 6 |

| | | | | |
|---|---|---|---|---|
| | | | with concerns of EU member-states for the implications for their exchanges fed into ECB T2S proposal. | |
| 4. | Cross-marketplace book-entry transfer of securities | SSE development team, Local CSD technical teams, Euroclear legal advisers, SSE ICT suppliers, high-speed secure network technical components, database software, High-performance computing hardware, MACs, National fiscal authorities, National governments | The issue around the Legal Record got solved thanks to the ability of the high-speed secure networks, database software and high-performance computing to performing the mirroring necessary in a secure, resilient, and reliable way and with the volumes and speed needed to ensure timely and uncontested finality of transactions in such a way that DvP as defined by BiS would be achieved | 1, 3, 6 |
| 5. | New algorithm and settlement failures | SSE development team, SSE technology providers, SSE technology consultants, Traders/dealers, Settlement banks, Regulators | Euroclear used workshops and training sessions for Market Participant post-trade technical and business process specialist teams to work through concerns and allay fears about how existing transaction failure management might be affected by the use of the new algorithm by ensuring they had a sufficient understanding of the potential changes to be able to understand for themselves how the changes might play-out in relation to their own operations and transacting practices. | 1, 4 |
| 6. | Cross-border payments | APIs and electronic messaging technologies, SSE development team, MACs, Central bank RTGS technical teams, ECB technical teams, ECB board, National governments | While functionally the links using central bank payment channels were operational, the issue around interfacing vs. integrating between the Target 2 inter-central bank payment system and the SSE remained a sticking point which led to the proposal by the ECB to develop its own cross-border T2S platform and around which many of the other persisting controversies around the distribution of benefits, ownership and governance, and unfair competition coalesced. | 1, 2, 3, 4 |

**Table 3: Summary of key controversies, the relations among them, the actants involved, and their evolution. The acronyms used are explained as follows: EU (European Union); SSE (Single Settlement Engine); CSD (Central Securities Depository); MAC (Market Advisory Committee); ECB (European Central Bank); T2S (Target 2 Securities); ICSD (International Central Securities Depository); DvP (Delivery versus Payment); BiS (Bank of International Settlements).**

In relation to the first research question about how key actants are positioned in relation to the key controversies identified, the detailed description of how cross-border book-entry was to be achieved and how the resulting processing of the much larger volume of transactions would take place in the SSE shows that the actants involved in the controversies associated with market integration can be as much ICT components and systems as human entities, organisations, and institutions.

Much effort from the developers had to go into the identification and enrolement of ICT entities. It was crucial, for example, that the ICT components and systems involved in the cross-border book-entry functionality (databases, secure communication networks, data storage devices, processors) had to be in a position to achieve the ultra-high-speed and incontestable mirroring of legal record databases located in separate jurisdictions. The same is true regarding the components involved in performing the single-threaded flash-processing of the huge combined volumes of transactions from across the marketplaces to be integrated. At the same time, these technical components cannot be separated from the legal arrangements that make necessary that whole database mirroring.

The same is true in relation to securities lending and transactional failures and the controversy around the new settlement algorithm and the optimisation routines it incorporated as well as the controversy around the investor ID field which linked directly the legal and fiscal needs for such information in one marketplace and the equally important need for anonymous trading in another, to the fundamental logical structure of a database.

The example of the controversy over the choice of *integrated* versus *interfaced* model for the interaction with the central banks and the Eurozone payment system not only shows how an issue, or controversy, spreads out from a question of technical interfacing to a much broader debate about the terms of broader European financial integration, but also how a number of preceding smaller controversies coalesced around an issue. For example, it brought together the ECB and a number of the large custodians with a concentration of business across the marketplaces to be integrated who expected to see their competitive position suffer as a result. Many of these were also involved in the controversy around how the benefits of integration should be distributed and also engaged in the controversy around the ownership and governance of Euroclear as shareholders of the new entity. Furthermore, one of these custodians was also engaged as an advisor, shareholder, and banking services provider of one of the large European exchanges that was a competitor of Euronext that was seen as gaining from the proposed cross-border market integration initiative. This in turn

brought into the controversy all the rival exchange operators to Euronext and, indirectly, the governments of the states where these exchanges were based through their representatives at the ECB.

The tracing of controversies summarised in Table 3, in line with the second research question, also illustrates how the controversies evolved and changed over time. Through this evolution, then, it is also possible to see the relations between the controversies identified but also how these relations change over time and in relation to each other. As Table 3 shows, the controversies numbered 1, 2, and 3 soon started to become intertwined and entangled, first among themselves, and, later on, with other ones. At the same time, however, their outcomes and evolution was very much conditional on the resolution of a number of technical issues regarding how cross-market place book-entry transfer might or might not be achieved, and how the volumes of transactions that would result could be processed so that the economies of scale and scope that were expected were realised and around the distribution of which, these three controversies were premised.

Finally, in terms of the main research question addressed by the study about how the market integration proposed by the developers gains durability, what can be seen is that it is not just the resolution of isolated controversies that is important, but also the relations and dependencies between them. This, in turn, also makes the sequence of their settlement important, as the settlement of one becomes a pre-requisite for another to either manifest itself or be resolved. In addition, the controversies often also relate to each other in a reciprocal way, with one changing the other and vice-versa. As one controversy is settled and a durable configuration of relations and positions of actants is established around it, the proposed marketplace gains durability and materiality, but at the same time comes up against other existing market structures in a much more concrete and unavoidable way. Furthermore, as the materiality of the proposed new marketplace arrangement becomes greater, it is much more onerous to make changes or put in place alternative arrangements.

# 5. Discussion

The study shows how the tentative demarcation of a new marketplace takes place through the establishment, structuring, and maintaining of links over a common ICT-based platform between an expanded range of transacting parties in a way that makes it possible for any particular pair out of a larger number of possible combinations to come together for the purpose of a transaction in a secure, seamless, incontestable, and determinate way. In this way, through the putting in place of common organisational and communication ties, coordination mechanisms, and relations of reciprocity between market participants, the proposed cross-border settlement system defines a new *transactional space*.

Before the introduction of digital electronic ICTs to the exchange of financial objects the geographic and jurisdictional spaces for their exchange were closely aligned (Appadurai, 2001). The introduction of electronic ICTs to financial transactions and the 'informatization' of securities through 'dematerialisation' (Donald, 2013; Norman, 2007) has undoubtedly removed many of the constraints of physicality and geography on the exchange of such financial assets. The circulation of securities has moved from a physical-geographical space to a digital electronic space defined by the relations and interconnections of computers and telecommunications networks and the circulation of electronic messages (Appadurai, 2001). But, as the research presented shows, establishing a space of circulation of particular financial objects of exchange (transactional space) by linking transacting parties through ICT connections does not, in itself, constitute a marketplace.

While ICTs may make possible the coming together of previously geographically remote transacting parties and the negotiation of the terms of a transaction between them (which is already achieved through the services of global custodians (Benjamin, 1996; 2000; Schwarcz and Benjamin, 2002), the issue of the delivery of the objects of the exchange in a way that ensures they retain *all* their qualities and characteristics is more complex (Benjamin, 1996; 2000; Schwarcz and Benjamin, 2002). This is because when securities are exchanged, they are only able to exist and circulate in specific jurisdictional spaces where "a

stable and reliable context in which objects and obligations are clearly mapped out and can be intersubjectively recognised" is in place (Slater, 2002, p.238). To use Slater's concept of *separative technologies* in economic exchanges (Slater, 2002), for objects of exchange such as securities to circulate, they need to be "materially and conceptually disentangled from their context as discrete and transactionable things" and become "items that can be passed from one context to another as property" (Slater, 2002, p.238). This detachment and attachment process is especially complex and fraught to achieve in practice across jurisdictions in the case of securities, which are defined through law, have specific property rights and obligations assigned to them in specific jurisdictions, and the modalities of their transfer are very precisely specified if their legal dimension is to be preserved.

### *5.1. From 'transactional space' to marketplace*

As the study shows, ICTs and the advances made in ICTs that made possible the ultra-high-speed and incontestable mirroring of legal record databases located in separate jurisdictions and the flash-processing of huge volumes of sequential transactions were crucial and necessary to the establishment of a single 'transactional space'. What the study also shows, however, is that, despite achieving this through the successful launch of the SSE, it is not sufficient to just establish a new 'space' within which circulations of securities can take place (Appadurai, 2001; Hetherington, 1997). It is also important to reconcile the views of themselves of key actants with the positions and roles anticipated for them in this new *transactional space*. Common understandings have to be developed in this respect among the wide range of market participants identified so that the new roles proposed by the marketplace designers for them are not only performed, but are also accepted as fitting with their own strategic outlooks (Hetherington, 1997). In the initiative studied this involved contestations, both at the level of market politics, around the competitive positioning of market participants, as well as at the level of geopolitics and institutional politics relating to the completive positioning of states, financial centres, and international institutions regarding

their place in a future digital and globalised financial landscape. As the T2S intervention of the ECB shows in this study, the ICT functioning of the new settlement system may work perfectly, but, a flaw in a small component of its conceptualisation in terms of the key business, economic, political, and institutional assumptions that are inscribed – or are to be inscribed – into it (Akrich, 1992) may result in the whole no longer being viable in the form initially anticipated.

A marketplace as a 'place', therefore, is defined by a combination of a 'space of circulation', the boundaries of which are defined by the immutability of the objects circulating within that space along the connections linking transacting parties (Callon and Muniesa, 2005), but also through the establishment of a system of subjectivities within which a wide range of market participants and their views of themselves and their interests in the wider world are accommodated in the conceptualisation and materialisation of that space (Hetherington, 1997).

### *5.2. ICTs and the transformation of capital markets*

So, what does this mean in terms of the overarching research question of this article about the role of ICTs in capital markets integration and by extension in financial globalisation and the assembling of liquidity? Furthermore, what implications do these findings have regarding the management of the complex causalities involved when pursuing market integration initiatives?

The insufficiency of seeing marketplace integration and financial globalisation as predominantly an ICT-enabled interconnecting of an expanded set of transacting parties points towards a role for ICTs beyond connectivity alone but one with important cognitive dimensions that enable the inspiration, planning, and foresight necessary for both developers and market participants to formulate their plans, strategies, and positions vis-à-vis the expanded marketplace arrangements.

**The role of ICTs beyond connectivity**

The interrelations of the controversies identified in the analysis of the empirical material and how the controversies with a greater proportion of ICT actants relate to those with more human actants sheds light on these cognitive characteristics of ICTs and the mutual shaping between the technological and the social.

One key area in which this bi-directional causality can be seen is in the establishment of *comparability*[11], both between existing local marketplace arrangements, but also between existing and possible future arrangements.

From the conceptual level all the way down to the level of the smallest technical components of the settlement platforms, one of the first practical tasks of those involved in the development of the Euroclear cross-border securities settlement system studied had been to establish a *comparability* between the five different marketplaces inscribed into the different legacy settlement platforms they were attempting to integrate.

What can be seen from the development of the SSE is that the original introduction of digital ICTs to the local existing securities settlement arrangements (e.g. dematerialisation of securities) contributed to the establishment of an initial degree of comparability that made possible the formation of a plan for the cross-border integration of five different settlement systems. Comparing the legacy settlement platforms that will eventually be replaced by the integrated one studied, it becomes possible to see that, despite idiosyncrasies in implementation, and differences in settlement practices and legal frameworks, their architectures at the most basic level share some important core similarities and functionalities.

This comparability is not only at a procedural level. The ICT building blocks of the settlement systems of the various marketplaces are also similar across different legacy market frames

[11] Comparability here is used in the sense of the Latin roots of the word which is comparare, “to make equal with, liken”, from com- ‘with’ + parare ‘to make equal’.

(e.g. Electronic messages, Parsers, Encryption and authentication technologies, Data communications networks and protocols, Databases, Algorithms). While the details of their modes of use and assembling may vary across different local marketplaces, they are understood and used in a similar way across the various local settings. The structure and format of an electronic message may, for example, be different, but the fundamental concepts and techniques of electronic messaging will be shared even in very different implementations. It is this common *description* of marketplaces in terms of ICTs that made possible the initial comparability that rendered explicit, visible, and calculable the actions and operations needed to integrate them.

In addition, with the introduction of ICTs to securities settlement, particular local settlement arrangements had, to some degree, become standardised through their expression in ICT terms. Thus, building on the standardising effect that resulted from the transcribing into digital electronic systems of particular marketplace arrangements using ICTs and their vocabularies and techniques, an *integrability* is fostered, as it is much easier to take apart and recombine the ICT elements of existing settlement system without having to radically alter or dismantle the existing local securities marketplace configurations.

In addition to ICTs, another important contribution to comparability was the concurrent assembling of a formalised body of knowledge relating to the clearing and settlement arrangements of financial markets. As can be seen from the timeline presented in Fig. 4 that follows, from soon after the 1987 market crash to about 2003, a whole raft of reports from international financial industry organisations such as the Bank for International Settlements (Committee on Payment and Settlement Systems, 1992; 1995; 2001; Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions, 2001), and the 'Group of 30' (Group of Thirty, 1988; 1990a; b; 2003) set out to codify securities settlement system arrangements found around the world and put forward best practice recommendations regarding their design and operation (e.g. defining DvP and different levels of DvP). Attempts were also made to

quantify, compare, and attribute the costs of clearing and settlement, especially at the EU level where the fragmentation of the capital markets was seen as an important impediment to the development of a single market and a source of economic inefficiency (Lannoo and Levin, 2001), setting in motion a wide-ranging controversy among market participants and public policy makers regarding how such costs could or should be measured ensued out of these initiatives (Deutsche Borse Group and Clearstream International, 2002).

[Figure 4 here]

Through their descriptions, comparisons, categorisations, and classifications of the systems, functions, processes, and risks involved in the settlement arrangements of particular marketplaces, these reports taken together contributed significantly to the framing and conceptualising of securities markets settlement, both domestically and across borders. This, not only informed the conceptualisation and planning of the Euroclear initiative presented, but also created, in the words of one of the interviewees who was a former senior figure at the Bank of England responsible for market infrastructures, “a degree of industry-wide coordination”, which increased receptiveness, both among market participants and public policy makers regarding the need for efficient, robust, and technologically advanced clearing and settlement arrangements for financial markets (Interview A1). As a result, an industry-wide shared understanding of the issues started to take shape and best practice and standards suggestions included in these reports increasingly taken into account. Out of the reciprocal shaping that took place between the formalisation of knowledge of clearing and settlement and the establishment of ICT-based settlement systems, differences and similarities and strengths and weaknesses between systems started to become much more visible and explicit and a wider common awareness of the strategic importance of such systems to both commercial and public policy objectives started to emerge. These new sociotechnical understandings and conceptualisations inevitably informed the integration

strategy of Euroclear going into the corporate mergers out of which the new cross-border group emerged, but also the planning and development work that went into the building of the cross-border settlement system.

Of course, the importance of the assembling of a formalised body of knowledge to the development of technological and financial innovation is not surprising or new, but what is important here is the illustration of the inter-relatedness of the human and the technical and the mechanisms through which these interrelations motivated and informed marketplace integration.

**Making the consequences of market integration explicit**

As the putting in place of the SSE shows, one of the results of the *integrability* of ICTs discussed above is that it enables the relatively easy assembling of key functioning parts of the new settlement system without the need for the full solution to be in place. This, in turn, created the necessity for specific *material* rather than *discursive* responses from the world around it (Barry, 2002).

The development of the SSE illustrates how, as the controversies where the actants that have to be enrolled are predominantly technological and more directly controllable by the developers are settled, an initial tentative but concrete functioning entity such as the SSE gives the abstract conceptualisation of a common cross-border marketplace a durability and materiality. As a result, it starts to make concrete demands on the world around it and affects changes and transformations to that world. Once in place, the SSE is no longer just a plan for a set of databases and algorithms running on very fast and powerful computers communicating through high-speed secure electronic data communications networks via a set of electronic messages with five existing legacy platforms and their databases. It has become instead a key junction linking together five already large pools of liquidity into one single aggregate pool comprising of “over 60% of the Eurotop 300 [equities], 52% of the

domestic fixed income securities outstanding in Europe and, 62% of Eurobonds" (Euroclear, 2002, p.6) and, in the process, realising significant network effects and economies of scale that help to reinforce its durability. It becomes like a keystone, holding an entire structure together and increasingly difficult to remove or change.

This durability makes much more explicit and visible to those concerned the implications that the abstract concept of marketplace integration will have in concrete terms (e.g. the scale of transfers of cash liquidity in an out of the ECB's Target 2 payment system).

This new entity of the SSE starts to set limits on possible events (Barry, 2002) and starts to make explicit its needs from, and consequences for, the world around it. It becomes a concrete interrogation of the existing world – both conceptual and material – surrounding the integration initiative (Barry, 2002). Seen in this way, points of interface between the emerging securities settlement system and other existing sociotechnical systems and networks are not only technical problems to be solved, but a nexus of actions, questions, and responses on the part of a range of agencies required to respond to the concrete demands and implications of the new entity. It is through these responses generated by the materialisation engendered by the integrability of ICTs that new and often obscure aspects of an abstract proposed future state become knowable to these agencies (Muniesa, 2011; Muniesa and Linhardt, 2011).

## 6. Conclusion

ICTs have made it possible for remote transacting parties to encounter each other and negotiate the terms of an exchange across geographical distances and territorial boundaries (Sassen, 2005). Such technologies have also made possible dramatic increases in the volumes of transactions that can be processed and reductions in the cost and time needed to process transactions . A semblance of globalisation is imparted to securities markets by the existence of global-scale financial service providers (e.g. global custodians) who have

used ICTs, internalisation, and their networks of subsidiaries and/or local agents to provide the necessary intermediation for cross-border financial transactions to take place (Benjamin, 1996; McGill and Patel, 2007; Norman, 2007; Schwarcz and Benjamin, 2002). These financial intermediaries, in effect, act as bridges linking together, in a global patchwork, disparate and discreet and still nationally-organised marketplaces and pools of liquidity (Norman, 2007). As the research has shown, however, in the case of securities, their exchangeability comes from complex entanglements with particular local sociotechnical arrangements that create a need for congruence between jurisdictional, geographical, and ICT spaces in the exchange of financial assets.

The outcomes and trajectories of market integration are difficult to anticipate and to see the role of ICTs simply in terms of a technical linking-up of previously geographically separated transacting parties and pools of liquidity is highly limiting. The relationships between the technical and social linking-up involved in such integration are highly complex in terms of both the number of relations but also because of the reciprocal forming and changing of entities resulting from those relations. It is a major challenge, as a result, in capital markets integration initiatives to understand and manage such complexity, as the inception, planning, and development of such initiatives are difficult and the forecasting of their benefits and risks contestable and uncertain. It is therefore important to recognise and seek to understand better the crucial role ICTs play in the cognitive framing of market integration as is identified in this research. This is because it is through this framing that the important reconfiguring of the subjectivities of market participants is effected as it makes knowable to them previously obscure aspects of a new marketplace configuration and their possible positioning within it.

The tracing of the controversies deployed in this study provides a method of analysing the complex and varying causalities found in financial markets transformations and of mapping a path through them. Such an approach can inform future market integration strategies regarding how to plan and manage their development and how to use ICTs more effectively to further these strategies by providing, for example, ways to better forecast the actants that

will need to be enrolled, the potential resistances they may bring, the reasons for these resistances, and how to overcome them, or at least take them into account, in planning, even if they are not fully visible and knowable in advance.

Many recent financial innovations, from complex derivatives and high-frequency trading to the operation of ‘dark pools’, ‘crossing’ networks, index-tracking funds and ETFs are premised on low-cost execution of trades and the ability to trade as much as possible anything anywhere at the click of a button (Skinner, 2007). This is enabled by the kind of infrastructure development and technological innovation that this study describes and analyses (Schmiedel and Schönenberger, 2005). To understand better financial innovations, their operation, and the benefits and risks they bring (Diaz–Rainey and Ibikunle, 2012), it is crucial to study these often-ignored infrastructures that make them possible (Thrift, 2004). Doing so, it is possible to see that the transformations taking place in capital markets and the innovations these relate to are not being driven either by technology or (de)regulation, but by a complex dynamic interaction and mutual shaping among technology, regulation, commercial and geo-political competition, new product and services development, and growth in demand. The challenge for both academic researchers and commercial and policy practitioners with an interest in forecasting the way complex adaptive systems such as financial markets will unfold is to devise better ways to engage with the complexities of such phenomena. This study goes some way towards illustrating how a novel approach for doing so can yield new insights regarding the role of ICTs in financial globalisation and the development of infrastructural approaches to supply-side analyses of financial innovation (Awrey, 2013).

### *6.1. Limitations and further research*

Based on a single case, this study may lack direct generalizability. This limitation, however, has to be weighed against the in-depth insights it provides and the scale and uniqueness of

the initiative studied (Flyvbjerg, 2004). In addition, this single case accounts for a large proportion of the phenomenon being studied, encompassing the trading of more than 60% of Eurotop 300 equities, 52% of the domestic fixed income securities outstanding in Europe, and 62% of Eurobonds held (Euroclear, 2002). Furthermore, the scope for more cases was limited by the lack of similar or comparable cross-border securities marketplace integration initiatives elsewhere, with few other attempts at establishing some sort of cross-border securities market integration having been undertaken and of those few undertaken, none being directly comparable to the one studied (Clearstream International, 2004; de Carvalho, 2004; Norman, 2007).

Another limitation is the restricted coverage of the Target2Securities pan-European initiative launched by the ECB. While this will be crucial to the future of the Euroclear integration initiative and the design and development of T2S might be a directly comparable study to the one presented, covering T2S would require a similar study to the one presented here in its own right, and this would be beyond the scope and limitations of a single article. Furthermore, the time horizons for such projects are long (the development of T2S is still on-going), so it would not be possible to undertake the necessary empirical study in a timely manner. The ECB counter-initiative, however, would represent a natural continuation for further research into processes of sociotechnical integration of securities marketplaces and a second case with which to compare the findings of the research presented here.

Finally another direction for future research could be to study in more detail the dependencies between sociotechnical controversies and their evolution and eventual outcomes and see if it is possible to formalise their analysis in terms of the sequence of their resolution, the identification of actants, the likely resistances they may bring, and the reasons for them, and how they might be overcome.

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## Appendix A: List of Euroclear consultation and project documents used in the research

***Euroclear Settlement of Euronext-zone Securities (ESES)***

- Update paper: Investment funds in ESES - Service description (October 2006)
- Update paper: Migration to ESES - Launch scenario (August 2006)
- Update paper: ESES Blueprint - Edition 5 (July 2006)
- Update paper: Transaction lifecycle in ESES - Service description (April 2006)
- Update paper: Reference data in ESES and migration of reference data from legacy systems to ESES - Service description (April 2006)
- Update paper: Physical securities handling in ESES for the Belgian and Dutch markets - Service description (April 2006)
- Update paper: Reorganisation events and transformations in ESES - Service description (March 2006)
- Update paper: Foreign securities in ESES - Service description (March 2006)
- Update paper: Settlement banks' reporting and control tools for Euro as from ESES - Service description (March 2006)
- Update paper: Market claims - Service description (February 2006)
- Update paper: Stock distributions - Service description (February 2006)
- Update paper: Mandatory cash distributions - Service description (August 2005)
- Consultation paper: Migration of data from RGV to ESES (July 2005)
- Consultation paper: Physical securities handling in ESES for the Belgian and Dutch markets (June 2005)
- Consultation paper: Foreign securities in ESES (June 2005)
- Consultation paper: Euro DVP settlement in central bank money - Settlement bank control tools (May 2005)
- Consultation paper: Reorganisation events and transformations in ESES (April 2005)
- Consultation paper: Transaction lifecycle in ESES (March 2005)
- Consultation paper: Euro DVP settlement in central bank money (February 2005)
- Consultation paper: Stock distributions and distributions with options (January 2005)
- Consultation paper: Market claims (January 2005)
- Consultation paper: Mandatory cash distributions (November 2004)

***Early harmonisation and Single Gateway***

- Update paper: Early Harmonisation and the Single Gateway - Service description (August 2006)

***Common Communication Interface (CCI)***

- Update paper: Common Communication Interface - Service Description (January 2006)
- Update paper: Common Communication Interface - Consultation response (January 2005)
- Consultation paper: Common Communication Interface (June 2004)

***Single Platform***

- Update paper: Single Platform Custody Blueprint - Edition 1 (November 2006)
- Update paper: Meeting services on the Single Platform - Service description (October 2006)
- Update paper: Securities accounts and payment structures on the Single Platform - Service description (October 2006)

- Update paper: Securities financing and settlement windows on the Single Platform - Service description (October 2006)
- Update paper: Primary market issuance and physical securities on the Single Platform - Service description (October 2006)
- Update paper: Transaction lifecycle on the Single Platform - Service description (September 2006)
- Update paper: Reorganisation events on the Single Platform (Part two) - Service description (August 2006)
- Update paper: Early Harmonisation and the Single Gateway - Service description (August 2006)
- Update paper: Securities reference data on the Single Platform - Service description (July 2006)
- Update paper: Reorganisation events on the Single Platform (Part one) - Service description (July 2006)
- Consultation paper: A market discipline regime on the Single Platform (May 2006)
- Consultation paper: Transaction reporting on the Single Platform (May 2006)
- Consultation paper: Miscellaneous items on the Single Platform (May 2006)
- Update paper: Settlement banks' reporting and control tools for Euro as from ESES - Service description (March 2006)
- Update paper: Market claims - Service description (February 2006)
- Consultation paper: Meeting services on the Single Platform (February 2006)
- Update paper: Stock distributions - Service description (February 2006)
- Consultation paper: Euro DVP settlement in central bank money on the Single Platform - further harmonisation for the payment structure (December 2005)
- Consultation paper: Sterling DVP settlement in central bank money (December 2005)
- Consultation paper: Reorganisation events on the Single Platform (Part two) and open transaction management (November 2005)
- Consultation paper: Securities reference data on the Single Platform (November 2005)
- Consultation paper: Primary market issuance and physical securities on the Single Platform (October 2005)
- Consultation paper: Securities financing and settlement windows on the Single Platform (October 2005)
- Update paper: Mandatory cash distributions - Service description (August 2005)
- Consultation paper: Reorganisation events on the Single Platform (Part one) (July 2005)
- Consultation paper: Transaction lifecycle on the Single Platform (July 2005)
- Consultation paper: Structure of securities accounts on the single platform (July 2005)
- Consultation paper: Euro DVP settlement in central bank money (February 2005)
- Consultation paper: Stock distributions and distributions with options (January 2005)
- Consultation paper: Market claims (January 2005)
- Consultation paper: Mandatory cash distributions (November 2004)

***Convergence - Business Model and Harmonisation Newsletter***

- Convergence - Issue 6 (December 2006)
- Convergence - Issue 5 (July 2006)
- Convergence - Issue 4 (February 2006)
- Convergence - Issue 3 (June 2005)
- Convergence - Issue 2 (January 2005)
- Convergence - Issue 1 (October 2004)

***Overview and background***

- Business Model and Harmonisation (Euroclear website)
- Update paper: Single platform implementation plan (March 2005)
- Consultation paper: Harmonisation Fundamentals (June 2004)
- Consultation paper: Harmonisation Preliminary Proposals (June 2004)
- Update paper: Business plan for Systems Consolidation (November 2003)
- Update paper: Inventory of harmonisation needs - edition 1 (October 2003)
- Update paper: The Business Model and Harmonisation consultation responses - Edition 1 (September 2003)
- Overview and planning (September 2003)
- Consultation paper: Harmonisation Roadmap (April 2003)
- Consultation paper: The Euroclear Business Model, further details - Edition 1 (April 2003)
- Brochure: CREST & Euroclear - Delivering a domestic market for Europe (September 2002)
- Delivering a domestic market for Europe - Business Model (July 2002)

## Figures

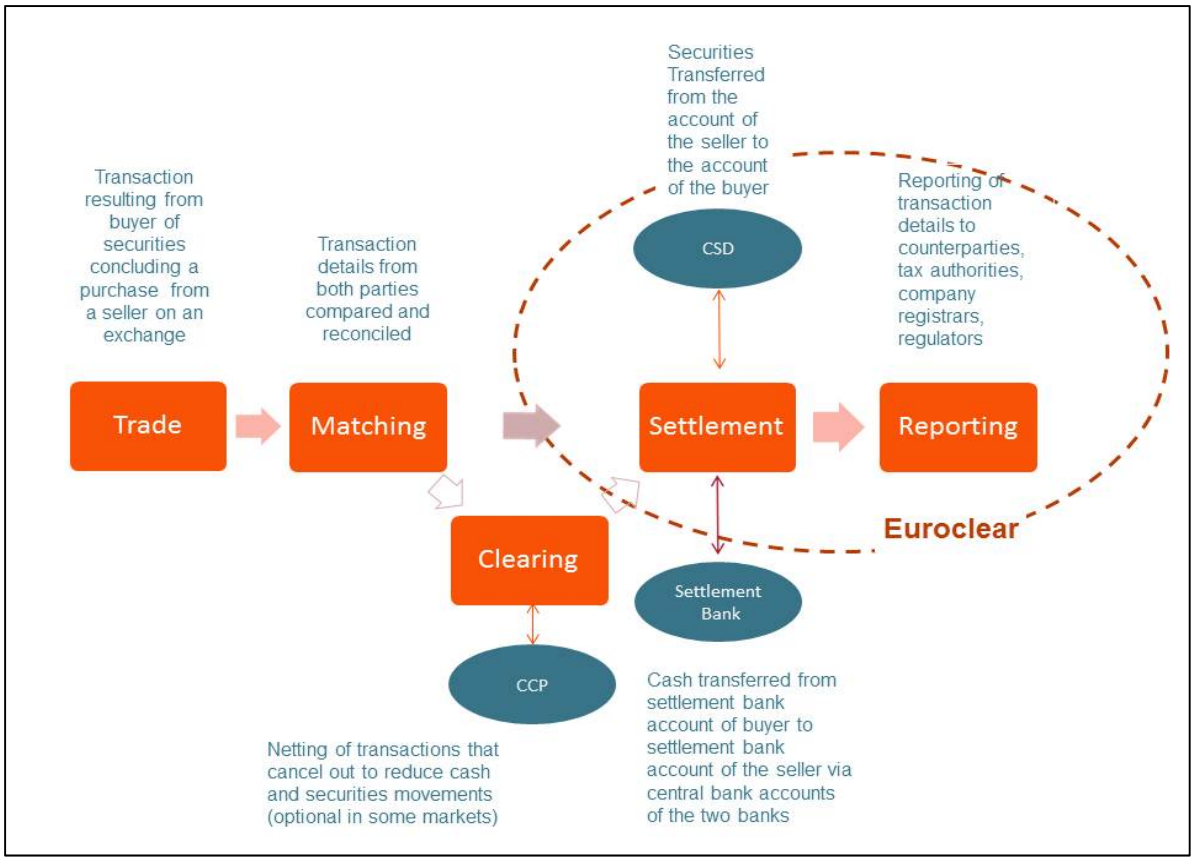


**Figure 1: The position of the settlement system in the securities transaction process.**

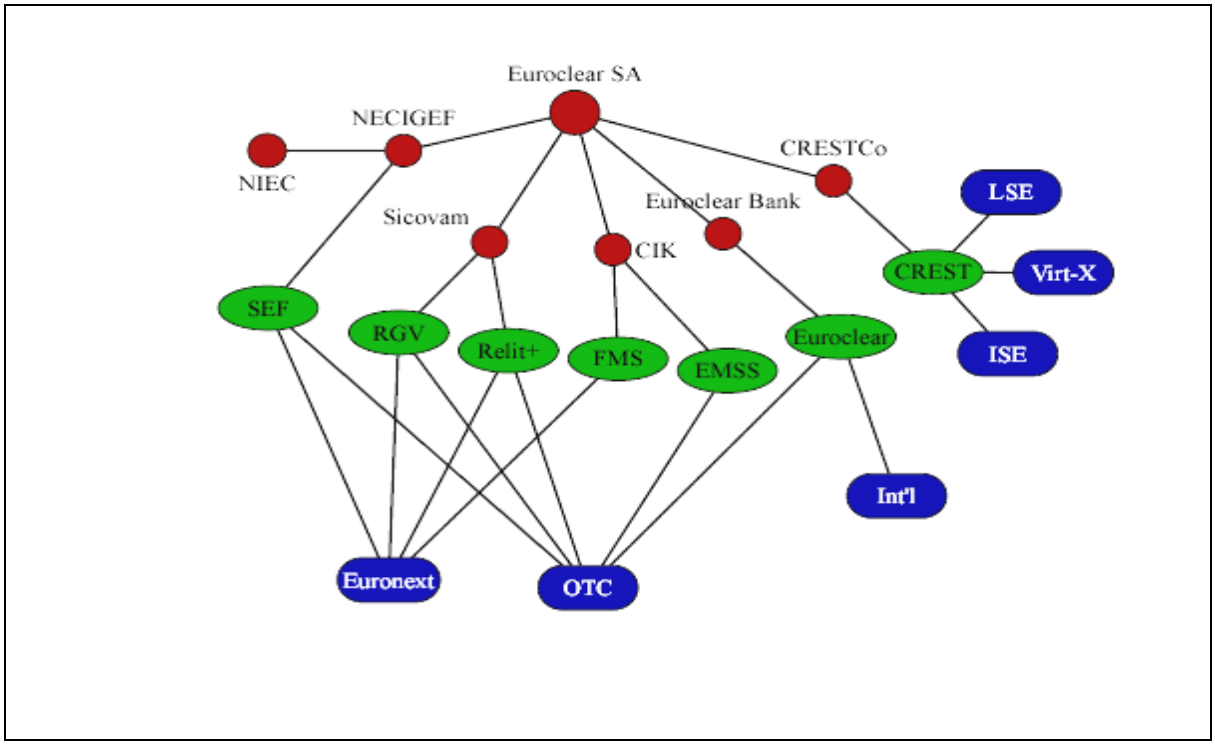


**Figure 2: Visual representation of the relationships between corporate entities (red circles), settlement platforms (green ovals), and marketplaces (blue lozenges) following the mergers between Euroclear and the CSDs. It was envisaged that all the existing platforms (green ovals) would be replaced by the Euroclear Single Platform with the SSE at its centre.**

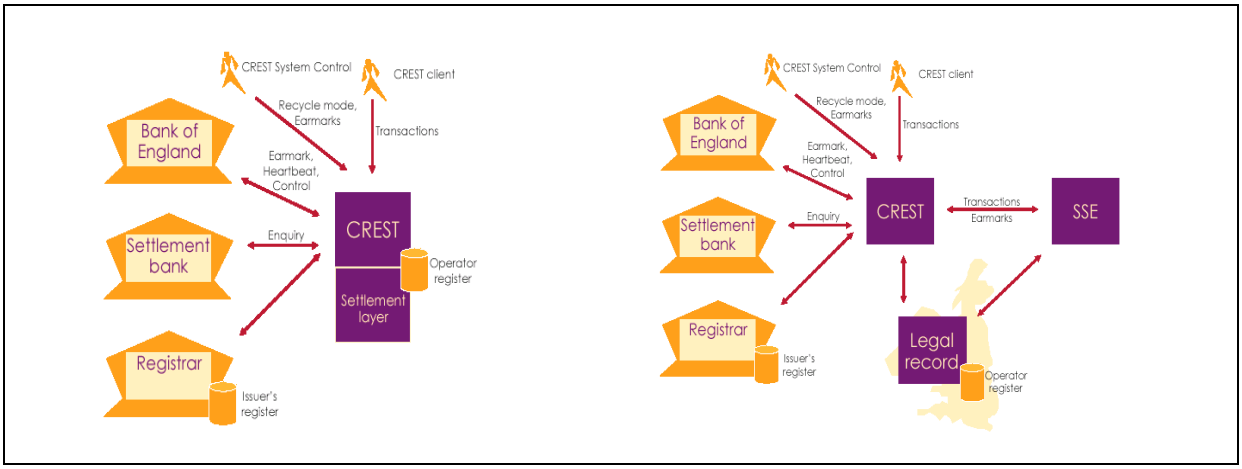


**Figure 3: Transfer of legal title to securities in CREST before and after the introduction of the SSE (source: Euroclear)**

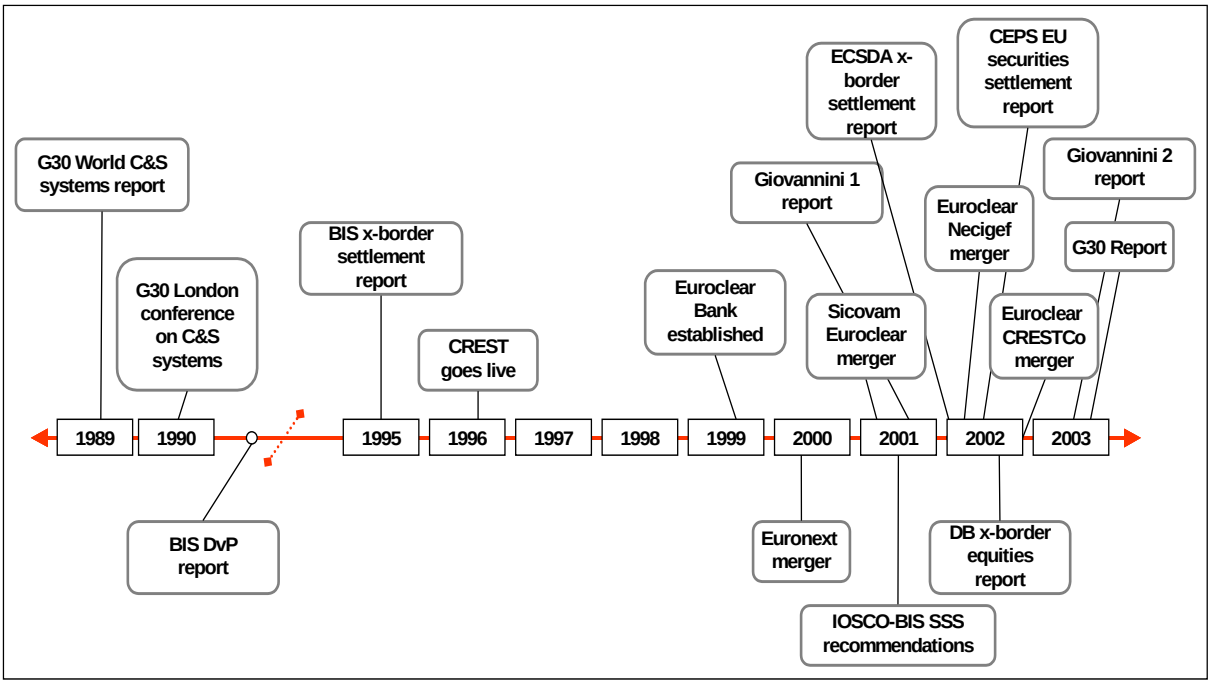


**Figure 4: Key reports contributing to the emergence of a formalised body of knowledge around the clearing and settlement arrangements of financial markets and their relationship in time to the evolution of the Euroclear integration initiative.**