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# **Electronic Securities: The Introduction of an Electronic Registration and Settlement System for the Norwegian Securities Market**

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**Abstract.** The development of computerized systems in the financial industry facilitated the growth of the stock exchange market for institutional and private investors. Paperless settlement systems for stocks and bonds were first introduced in the Nordic region. The successful introduction of the new infrastructure for the securities markets was the result of solid cooperation between market participants and authorities, which made it possible to implement major changes in the incumbent manual systems in record time.

**Keywords:** Central Securities Depository (CSD), electronic registration, financial industry, stock exchange market

## **1 Introduction**

Back in the first half of the 1980s, the Norwegian securities market experienced a tremendous growth. The stock exchange market started to develop from a rather closed community to an open marketplace with a large number of both institutional and small private investors. The number of transactions challenged the incumbent manual systems. Equity turnover increased from NOK 1.7 billion in 1982 to 31.8 billion in 1985, and bond turnover increased from 5.8 billion in 1983 to 75.9 billion in 1985. At its worst, it had taken over three months before a transaction at the stock exchange was settled and new share certificates were issued to the buyer.

The market was close to a systemic crisis and among its participants there was broad consensus for a major change. The idea of a dematerialized Central Securities Register developed rapidly. In 1982, the Minister of Finance, Rolf Presthus, announced the need for a modern securities infrastructure, and urged the banks and the other market participants to find a solution. He said that a central securities depository would make it possible to introduce tax deduction for individual savings in shares as well as generally improve control regarding taxation of securities, which at that time was an important political issue. There was strong potential for an efficient operation to replace the physical securities of book-entries with an electronic register. The rights to shares and bonds would be linked to a registration rather than to a document.

Against this background, Norway's three main banks (Den norske Creditbank, Christiania Bank og Kreditkasse and Bergen Bank) established a committee in 1982

to study the introduction of a Central Securities Depository (CSD) in Norway. The conclusion from the committee was generally accepted, but there was a need for broader support from all participants in the market. An all-embracing project group was launched in May of 1983 to study technical and legal implications of an electronic system. Denmark had introduced the paperless registration of listed bonds in 1983 and the project group was much inspired by the Danish CSD organization VP. The project group delivered its recommendation in June 1984 and at the same time an interim company (Verdipapirsentralen under establishment) was set up. This organization immediately began to hire people to plan for the implementation of the ICT system and to prepare for market readiness.

## **2 The Stakeholders**

It was a challenging task establishing a new entity, like a CSD, in the network of players in the financial market. Some of them had an interest in retaining their existing business, or at least as much of it as possible. It was a reality that the new paperless system would result in substantial cost reductions due to the major decrease of manual operations and consequent cuts in manpower. This was broadly accepted, even by the employees' organizations. The financial industry was experiencing tremendous growth and it was possible to move people to other positions. This situation lasted at least until Norway's bank crisis in the early 1990s, when thousands of people were laid off, partly as a result of the use of computerized systems and the reduction of manual tasks in the industry.

The stakeholders were more concerned that the new system would change the balance between the players. Until then, the largest players had invested in ICT systems and staff training to provide specialized securities handling. In addition, the companies had outsourced the operation of the share-register and corporate action handling to the banks. The largest players had economy of scale compared to the smaller ones and there was a major concern that the new system would change the balance of competition in the market. There was also a worry that the new entity would be too powerful and initiate a disintermediation of function from users and expand the scope of business.

## **3 The Business Model and the Legal Foundation**

The challenge was finding the right combination of a technical system and a legal platform. Traditionally, the legal rights to a share had been linked to a physical document, the share or bond certificate. In order to exploit the efficiency of a fully computerized system, it was imperative to remove such paper handling and to change the regulation to allow electronic registration of securities.

In the record time of just one year, a new law for a Central Securities Register was enacted, including changes to the law governing companies, and other related regulations. Some legal specialists later criticized some detailed parts of this law, for example, what amount of time in the computer systems should be used for priorities

between concurrent claims and pledges. It subsequently took a period of three years to solve these detailed issues.

The legal and organizational design was based on some important cornerstones: the electronic register would be based on the concept of accounts for the owners' securities and on sub-registers for information about the issued securities.

The CSD was regulated in a special law, which determined its status and organization. The law also regulated the legal conditions and implications of electronic registrations. VPS was given exclusive rights to carry out registrations according to the law. The new entity's scope of business was strictly prescribed to running the securities register and some connected tasks, like operating the securities' settlement system.

The company would be organized as a self-owned and self-financed institution led by a broad-based council and a smaller board of directors.

To utilize the current network of customer services, account operators such as banks and brokers were to carry out all registrations. The concept of central and de-central registration was not only an efficient way of utilizing the current infrastructure, but also an important division of work. The banks and brokers network would maintain their customer relations, and the CSD would provide the technical infrastructure and operate the register.

There were, however, discussions about direct access for large investors and companies. Some of these were worried that intermediaries would add costs to the use of the system. The banks, for their part, were concerned that the CSD would bypass their business and offer services directly to their clients. After many years of operation, the experience is that the bank/broker network still has the customer relation, but most of the services connected to the register information are delivered by the CSD as an application service provider. The added cost of the banks/brokers for the basic services has been reduced over the years and more or less covers "cost plus" today.

Political problems emerged in the government during the processes. The right wing government supported the introduction of the proposed new securities system, with the exception of the mandatory registration of all Norwegian bonds and securities listed at the Oslo Stock Exchange. The Ministry of Finance stated that VPS would be a rational and efficient central securities register and that mandatory registration was regarded as unnecessary. The regulation was, however, changed a couple of years later, imposing compulsory registration of the main financial instruments in the Norwegian market. This amendment was primarily explained as a consideration for efficient tax control.

## **4 The IT Design**

The planning and analysis of the business architecture started in parallel. Since the business model was based on central registration and decentralized customer service, it was rational to use the current banking network for data entry, inquiries, and reports. Most of the brokers had in-house ICT systems for client ledgers and accounting, but trading at the Stock Exchange was still floor-based, which required

that personnel from the brokerage firms were present at the stock exchange. The ICT architecture had to combine the current network with the new application requirement for reliability, safety, and privacy. Leased direct lines were regarded as providing acceptable security against fraud and misuse of information. While decryption of the lines was an option for the customers, it was never made a requirement for access to the system and, not surprising, was never used. There was, however, much effort spent in setting up an extensive end-to-end control to identify the connected terminals and users. The weak point regarding control was the existing connected bank/broker network. The central system had limited control over the reliability and protection of the local networks at the customer premises, which had to be regulated through agreements to reduce a potential loss for the CSD, due to security breaks at the locations of the connected users. After years of operation, no unauthorized access to the system has ever been discovered.

The design of the central system was a major issue. Time and costs were essential. Since it was too time-consuming to analyze and implement a new architecture from scratch, a quick decision was made to reuse the main architecture, platform, and application of the Danish system. The Danes had spent much effort designing and developing a state-of-the-art ICT system, applying the slogan "make it simple," both for functionality and technical implementation. The Danish platform was based on Yourdon's structured analysis and had a robust architecture with separate communication and application layers. The implementation was carried out on an IBM mainframe system, utilizing software components such as the S2000 database system, Roving spooling facilities, PL/I programming language, CICS transaction server, and other popular facilities from the 1980s. The book "Up and Running" by Dines Hansen from 1984 describes the design and implementation of the Danish securities system.

In retrospect, not all of these choices were the best ones. The S2000 database system was replaced with DB2 after some years. In addition, the industry's use of PL/I decreased over the years and it was difficult to hire people with PL/I knowledge. This made the company vulnerable with respect to critical know-how. The architecture was robust for many years, until the Internet applications required more flexible functionality for the end-users. On the other hand, the system was up and running in a very short time and the operation cost proved to be competitive. The cooperation with the Danes was very helpful and the system was in use by mid-1986, after less than two years developing and implementing it.

The support agreement with the Danish VP for systems and implementation had a price tag of DKK 25 million, which mainly covered the basic system for the bond market. VPS had to develop the functionality for equity and other requirements for the Norwegian market. After eighteen months developing and testing the system, the first production started in May 1986. The total investment in systems, hardware, and software was approximately NOK 100 million, of which about one half was for system development, including the fee to VP in Denmark.

## **5 Up and Running**

The practical preparations for the establishment of the company VPS were started at the same time as the working committee delivered their recommendations. In June 1984 the main players took the chance to finance and establish an interim company. This organization began to hire people, rent office space, acquire hardware and software, and make agreements with the Danish CSD organization VP. The cooperation with VP was crucial. The use of the Danish architecture and platform saved a lot of time for the approximately sixty people who were recruited during a six-month period. There was no time to discuss basic architectural ICT issues.

The planning of the project was a crucial task. This complex project had many stakeholders who all needed strong coordination. In spite of this, simple milestone planning with a minimum of paper and reporting was implemented. The master plan for the project was written on one A4 paper, and was the only report that the project leader used for the board of directors.

All employees were sent to Denmark for introduction training of the main framework of the system. In that way people were able to start with systems development for the Norwegian functionality directly. It was, however, a challenge that most of the people who were recruited had little knowledge about the highly specialized securities market. There was well-pronounced skepticism from the specialists in the banks and the brokerage firms about the new IT people. Nevertheless, bridges were built, user groups engaged, decisions taken and, after some time, respect was generated.

The first transfer to electronic securities in VPS started in May of 1986 with the commercial banks qua public limited companies. The rest of the companies were converted in September/October and all the bonds in November of 1986. Later, services have been expanded to other financial instruments like derivatives and mutual funds.

## **6 Who Should Pay?**

After implementation, one major question remained. Who should pay? Everyone was in agreement that the total cost was lower than before. However, should the new prices be related to the savings compared to the old system, to the use of the resources in the electronic system, or to a kind of market price? The annual cost of running the new system was approximately NOK 100 million for the first years and covered amortizations and operations' costs. In the plans and the analysis done prior to the start-up, it was stated that the fees for the users of the system should be cost-based. The challenge was to devise a model of how to distribute costs in a system with a 90 percent fixed cost-base. Another main problem was which elements should be charged for and who should pay for them. In the old document-based system, the costs were to a large degree connected to the manual handling and even to the value of the transaction. A political barrier was that the authorities had clearly stated that the small investors should not pay more for their ownership of shares and bonds than they had in the old system. For the broad majority this was close to zero, because

most people had their share or bond certificates in a drawer or under the mattress at home. Some people may have had their documents together with other valuables in a safe deposit box in a bank, but only the larger investors had their securities under safe-keeping in a bank, for which they paid an annual fee.

A purely cost-based model was in contradiction to main pricing models in the financial sector. It was not natural that a company or a bond with a capital of one billion should pay the same as one with ten million, which raised a new debate between the bond issuing firms and the public limited companies. The bonds usually had substantially higher value than equity, especially when we include the government bonds. The problem with prices based on a purely cost-based model was that all units tended to cost the same, for example, the fee for an investor account for Goldman Sachs would be the same as one for Aunt Olga. It became obvious that we had to combine a cost-based model with one that was broadly accepted in the industry, taking the political limitations into account. A long debate started among the board members and in the trade organizations for the different user groups, going so far that the board and management were threatened with legal action. At one point, the employees' representative in the board asked the members; "If you really think the costs are so high, why did you start this project?" He was assured that everyone was better off than before and that it was purely a debate on how to divide the cost between the different user groups.

In Denmark, a quite different approach to dividing the cost had been taken. There, a small group of the users had been gathered and the main distribution of costs between them had been determined. At the end of the year, any discrepancies in the budget were cleared and settled. We sometimes regretted that we had not chosen the Danish approach.

After some hard work, the company managed to produce a cost and price model which was broadly accepted by all user groups. The concept was based on an analysis of all cost generators of the main services. For example, the distribution of costs from the computer system was calculated according to the use of computer resources such as use of CPU minutes, disk access, use of storage, network utilization, back-up capabilities, and operating hours, among others. An internationally recognized consultancy firm controlled the model and the figures. This gave the company a cost base, which was used to calculate fees according to a set of business principles, the main ones of which included the following:

- The user who generates a transaction has to pay for the service
- Some services should have fees based on capital value rather than costs
- Small investors are exempted from paying for the use of a securities account
- A special fee for large investors should cover the costs of the small non-paying clients
- The banks should receive compensation from the issuers for customer service to the small investors
- Some charges should have volume discounts

The distribution between user groups after the new cost/price model was that the investor group should pay approximately 25 percent, the brokers 25 percent, the bond issuers 15 percent, and the issuers of equity 35 percent. Over the years, this

distribution has changed with the development of the market and the introduction of new services.

After years with a high degree of tension, the pricing system ended up in a hybrid resource/market pricing schedule which still uses the main principles, but with some adjustments. The cost model has been developed to reflect the fact that today's cost generators are manpower and not computer resources. The fees have been gradually reduced, because the volumes have increased substantially more than the costs.

## **7 Lessons Learned**

The establishment of VPS and the transition to a dematerialized securities system has, without doubt, been a great success. One of the reasons was that new regimes were continuously implemented. The old workflows were not copied, the banks, brokers, and issuers had to decommission their old systems and implement new business rules for the processing of settlement, custody, and corporate action. In fact, the changes were so substantial that they would probably not have been possible to implement, if the market had not been in crisis. Of course, it helped that the authorities could introduce better tax control of securities capital and transactions. The years after have proven that all participants in the market have benefited from better control of the securities market facilitated by increased transparency and consistent procedures.

Later analysis has shown substantial cost savings, better control, and faster market operations for both intermediaries and end-customers. A major player in the London market put it this way, "In Norway you have created a national securities infrastructure with integrated custody, registrars and settlement agents for less than 25 mill € pr year, no one can beat that."

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