

Information System of Stock Exchange Market in Serbia

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Summary

The aim of this paper is to present the concept of information management in new trading system of the Belgrade Stock Exchange based on FIX protocol. It considers main characteristics of the FIX protocol structure, characteristics and technical solutions. Beginning with the ICT infrastructure in Serbia, main part of the paper is concentrating on the FIX protocol implementation and the importance of this protocol in the frame of the Belgrade Stock Exchange and its connection with regional and European financial markets. FIX protocol is seen as an imperative to go on with the capital market development in Serbia, with the multiple positive effects of this new solution, both for individual participants and the entire financial market, like efficiency increase in operations control in the trading process on the participants side and rise in trading reliability and decrease of mistakes or errors on the financial market side.

Key words

Management, FIX, stock exchange, BELEX.

Introduction

The capital market of Serbia is in a relatively early stage of development which inevitably calls for frequent interventions in existing regulations or the setting up of new ones, in order to adjust them to the needs of everyday practice. The basic regulatory framework of the current situation is set out in the Law on Market of Securities and Other Financial Instrument passed in 2006, (based on effects of December 11, 2006). In accordance with the law, the Belgrade Stock Exchange (BSE) is the only organizer of security trading in Serbia. Apart from the BSE, the Ministry of Finance of the Republic of Serbia, the Securities Commission, the National Bank of Serbia, the Central Securities Register, broker-dealer companies, commercial banks, and purchasers and sellers of securities also take part in securities trading (Figure 1).

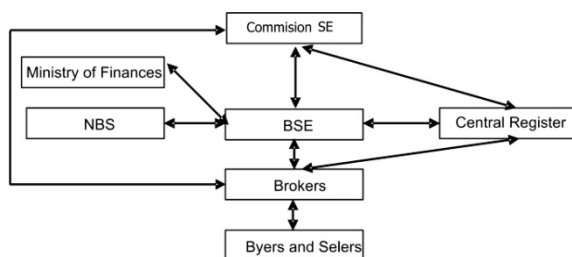


Figure 1 Participants on the Serbian capital market

The Belgrade Stock Exchange is formed as a joint-stock-company, pursuant to the Law on Securities. It was founded by commercial banks and

insurance companies. Today, its members are 88 broker-dealer companies licensed by the Securities Commission, among which there are fifteen banks authorized by the National Bank of Serbia to operate as brokers. Registration of transactions executed at the Belgrade Stock Exchange is made in the Central Securities Register (100 percent owned by the state).

1. Belgrade Stock Exchange operations

Unlike stock exchanges of highly developed economies, the Belgrade Stock Exchange of Serbia - in spite of being one of the oldest stock exchanges in southeast Europe - is still in early stage of development. Today, upon a five-decade halt after the end of World War II, it walks with long strides into the future in compliance with business conditions and the current level of corporate culture. Intensive cooperation with foreign partners during 2007 resulted in the first foreign-established index of the Serbian stocks (SRX by the Vienna Stock Exchange) and the sale of the first license for index BELEX15, on the basis of which structural products are produced and traded at the Frankfurt and Stuttgart stock exchanges. In the course of the same year, a partnership memorandum was signed with representatives of the Ljubljana, Zagreb and Skopje stock exchanges so as to promote the regional market, and the development, and production of regional stock-exchange products and services, as well as to service more successfully the needs of institutional and retail clients.

Since the Balkan region was considered to be, the fastest growing capital market in the world, in the first half of 2007, the Belgrade Stock Exchange's position has become relevant to the market. The relevance can be assessed on the basis of comparative data on relevant indices of stock exchange operations of the Belgrade Stock Exchange and other stock exchanges in the region that are of almost the same size and which operate on capital markets whose development stage is similar to that of the Serbian market (Ljubljana, Zagreb, Bulgaria, and Romania).

Table 1 Comparative data (constructed by public data)

Stock exchange	Market capitalization	Turnover in billions of euros	Number of markets	Trading system	No. of securities quoted	Number of members	Number of org. units	Number of employ-ees
LJSE	19.74	2.2	2	Novita	188	24	6	29
ZSE	48.00	9.1	6	OMX	459	46	5	27
BSF	24.60	4.4	2	Own	82	73	4	79
SOFIX	14.82	4.80	2	Russian/ German	509	76	5	38
BELEX	16.80	2.00	2	Own	1,784	88	3	40

When assessing the current and future position of the Belgrade Stock Exchange in the region, it is important to take into account that it is the only stock exchange in the region which announced the implementation of the FIX protocol. It can be expected that due to this fact, in the forthcoming period, it will be in a considerably better position and attract large world brokers and banks, which will contribute to the market improvements from various aspects. Furthermore, the data generated on the Belgrade Stock Exchange would be more easily accessible to the international business public, which would result in a positive investment climate in Serbia. It is certain that possible positive effects will depend on the context of the future political and economic environment.

Securities trading are carried out on two markets: stock market and over-the-counter market. There are two levels of listing on the stock market: A (prime market) and B (standard market). More than 1,700 joint-stock companies, established as such in the process of privatization, trade on the over-the-counter-market (OTC). The securities traded on the over-the-counter market are not subject to listing criteria, but taking into account that they are traded on the organized market they have to produce a shortened version of the prospectus if they are to trade. There are some special legal provisions under which these securities can be included on the Stock Exchange without the Prospectus. Trades in

debt securities performed by professional investors trading between themselves are recorded in a separate department of the trading system in order to provide information about the total supply and demand and the reached price for each security.

Trading on the Belgrade Stock Exchange is based on multilateral netting, the T+3 "rolling". At the end of each trading day, the Belgrade Stock Exchange e-mails the Central Securities Register about the executed trades. Register executes multilateral netting and informs the participants about their positions during the same day (T+0). In the moment of an order delivery, both sellers and buyers trading on the stock exchange have to have a sufficient level of securities on their accounts with the Central Securities Registry or money funds in commercial banks. The Central Securities Register, being a participant in the RTGS system of the NBS, is entitled to DVP settlement principle.

The Belgrade Stock Exchange has its own electronic trading system in compliance with requirements set by the modern-state-of-the-art organization of system set up for the needs of this industry. The trading system currently used, put into operation in November 2001, was set up for trading in bonds issued to reimburse the debt arising from frozen hard currency savings. The system has been modified several times in accordance with new market circumstances, and technological requirements. Later on, the electronic platform was also *expanded* to include stock trading. In technological terms, the most important element was a remote trading system which was established in 2004. The present system is one of the most modern trading systems in the region, and in line with all technology and performance criteria – advised by the EU.

The shift to the electronic trading system called for many changes in the operating process organization, much better possibilities of getting access to the system, number of shares comprised by the trading system, dissemination of information to the public, etc. The increasing demands of users, led to the development of the information function. BELEX.info (is the service of the Belgrade Stock Exchange that enables the distribution of trading information to all interested users in real-time (outside the circle of certified brokers that are stock exchange members) via the Internet. It is made up of three applications: BELEX.info web application, BELEX.info WAP service, and SMS. This service gives the users an insight into the current state of the securities market, that is price movements of all securities traded at the Belgrade Stock Exchange, the supply-demand ratio, as well as to the review

and a graph of the total realization, i.e. number of trades executed real time (Vuksanović, 2005, p. 7).

2. State of ICT infrastructure in Serbia

According to the Internet Usage Statistics (2009) the picture of Serbia on Internet is not too bright: it has just 32.4% of the population using the Internet, while there are 94.000 Internet hosts. Serbian Bureau for Statistics research (2008) shows that Internet reached 40.8% of users, with the 6.2% annual growth of new users. According to the same research, 40.8% of households in Serbia have a computer, while 97.7% of Serbian companies are using computers in their work. Information about Internet penetration from the same research shows that 33.2% of households and 91.5% of Serbian companies have the access to the Internet. Broadband connection is registered in 15.5% of households. Among Serbian companies it is possible to find different Internet connection types: DSL (57%), dial-up (32.6%), cable (22.6%), ISDN (13.2%), mobile phones (11.5%), and others (10.1%).

The Internet backbone in Serbia is called Serbian Multi-service Internet Network (SMIN) and it is owned by Telekom Serbia. It is accessible by modem from all over Serbia. SMIN is also used for the transfer of voice and data and for building Virtual Private Networks (VPNs). SMIN has four points of presence in the Serbian largest towns: Belgrade, Novi Sad, Niš, and Kragujevac, mutually connected by 155 Mbps lines. On the other side, SMIN is connected to the global network with two 155 Mbps lines. SMIN's basic offering is switched access via public telephone network or via Integrated Service Digital Network (ISDN) with the maximum speed of 128 Kbps.

More recently, the Asynchronous Digital Subscribe Line (ADSL) was introduced. The broadband lines are typically unaffordable for small and medium size enterprises and ISDN access is a more feasible solution for this user group. Although currently sufficient, SMIN's speed may cause congestion with the expected growth of the customer base. Access opportunities are much better in larger urban centers, while rural areas are disadvantaged (Jošanov, Vidas-Bubanja, Vuksanović, Kajan, & Travica, 2008, pp. 380-382).

Emerging broadband technologies such are ADSL2, VDSL, FTTx, WiMax, etc. are not in notable use (Travica, Kajan, Jošanov, Vidas-Bubanja, & Vuksanović, 2007, p. 42). Mobile telephony is on the rise in Serbia, with 3 GSM operators: national

Telekom Serbia, and two international - Telenor and VIP. According to the Serbian Bureau for Statistics (Usage of ICT in the Republic of Serbia, 2008), mobile phones exist in 74.5% of households, while 24.8% of Serbian Internet population is using mobile phones for the Internet access.

The Internet Service Providers (ISPs) market consists of 107 ISPs, where many of them are resellers of Internet access that is controlled by larger ISPs. International connectivity is provided mainly by Telekom Serbia and two private companies.

In the field of information infrastructure, we can find all of "Big3" vendors: IBM has 80, Microsoft is the second with 67, and Oracle is on the third place with 7 certified partners. The development of information infrastructure in Serbia is widely organized, with the special Ministry for telecommunications and information society on the top, but there are also other authorities, agencies, biggest companies, science institutions and educational centers that are taking part in that national project (Working Group for Implementation of the FIX Protocol, 2007, pp. 25-29).

3. Main facts about FIX protocol

Among the most important protocols in use today in financial world is FIX (Financial Information eXchange) Protocol (commonly called just FIX), with a series of messaging specifications for pre-trade and trade communication and it is experiencing rapid expansion into the post-trade space. This protocol is an electronic communications protocol developed for international real-time exchange of information related to the securities transactions and markets. FIX was initiated in 1992 as a bilateral communications framework for equity trading between Fidelity Investments and Salomon Brothers. Since then, several major versions of the specifications have been published.

It is the result of the joint development of world's main banks, broker-dealers, exchanges, industry utilities and associations, institutional investors, and information technology providers, which share a vision of a common, global language for the automated trading of financial instruments. FIX has become the standard electronic protocol for pre-trade communications and trade execution. We could say that SWIFT is the standard for back office messaging, while FIX is the standard for front office messaging. The FIX Global Survey conducted by Tower Group at the end of 2007 shows that 75% of buy-side and 80% of sell-side firms use FIX for electronic trading. FIX functionality has steadily expanded through the different

version releases into the post-trade space supporting straight-through-processing from indication-of-interest to allocations and confirmations. It supports the asset of classes like derivatives, fixed income and foreign exchange markets. There are seven numbered FIX versions; five of them are in use today, where each new version adds some capabilities (Houston, Brkić, Kiš, & Lazaridis, 2008).

Although FIX is open and free, it is not software, network, hardware solution, programming language, trading system, exchange, or market, but a document specification. Around FIX software developers can create software applications which could be integrated to a lot of order management and trading systems. The FIX is a series of written, public domain technical specifications for electronic communication of trade-related messages. More precisely, FIX is a series of messaging specifications developed through the collaboration of banks, broker-dealers, exchanges, industry utilities and associations, institutional investors, and information technology providers from around the world. The success of the FIX primarily lies on the efforts of its member firms, where the most important roles have buyers, merchants, vendors and exchange communities. These market participants share a vision of a common, global language for automated trading of securities, derivatives, and other financial instruments.

It is one of the similar self-describing protocols, more common securities trading systems. There are 2 main groups of FIX messages – messages for administration of the session (logon, heartbeat, test request, resend request, reject, sequence reset & logout) and messages with the business context (advertisement, indication of interest, news email, new order, executions, order cancel, order replace, order status & order messages). In this text we are analyzing only this second group of messages. The message is broken into three distinct sections: the head, body and tail. FIX messages are formed from a number of fields, each field is a tag value pairing that is separated from the next field by a delimiter. The tag is a string representation of an integer that indicates the meaning of the field (for instance, tag 48 is securityID and it identifies the security string). The value of each tag is readable text however fields can be encrypted. The FIX also defines sets of fields that make a particular message. Within the set of fields some will be mandatory and others optional. The ordering of fields within the message generally is not important.

FIX could be considered as one of the top themes concerning organization of Serbian's finan-

cial market. The fact that during November 2007, countries of European Union should start using this protocol on their markets, at least in the part of communication with distributors of the stock exchange data, indicate that FIX implementation in the Belgrade Stock Exchange (BSE) is getting on popularity in European frames.

4. FIX protocol implementation in BSE

The Belgrade Stock Exchange carries out all activities concerning the implementation process of the FIX protocol in Serbia. Apart from producing its own trading application, it coordinated the activities of all market participants, prepared a specification of the FIX protocol, and created a basic version of a broker application for trading at the Exchange (due to an inadequate level of technological development of numerous market participants). To implement the FIX protocol, the Belgrade Stock Exchange formed a special working group that defined a strategic plan of the new trading system development - BELEX FIX, whose key role is to communicate with legislative bodies, educate and promote. It was made up of the representatives of all institutions included in the securities trading process.

The implementation of FIX in BSE was based on open architecture of Quick FIX solution, which was already successfully implemented in Luxembourg. The solution of BSE on the server side is developed according to their own requests, with the basic modules from Quick FIX. This is the hybrid approach to the development, using all advantages of Quick FIX best practice together with the all specific solutions that are implemented in the work in BSE. The main role of this application is to provide the integral communication of brokers with BSE and the processing of broker requirements and messages from BSE, with their distribution to the broker applications. This server application has two modules – Client center is managing and processing all functionality of BSE and FIX API takes all the gateway functionality responsible for acquisition and distribution of all messages between BSE and broker houses.

Information system of broker houses in Serbia is usually organized through 3 main applications: activities with the Central register, trading activities in BSE (the subject of FIX implementation) and the back-office system. The FIX solution implemented in broker houses, on the client side of this communication system is the basic version of bro-

ker application developed by BSE. In the first phase all members of BSE are supposed to use this application and later they will be able to develop their own solution. This client side application has the full functionality for the comfort work in the stock exchange and it doesn't have any negative implication on the BSE gateway or their trading system and the members are always recognized by BSE server side. Their communication is standardized on implemented FIX documents and certificates for the work of members were created by BSE.

There are 2 main groups of implemented messages in this communication system:

- public messages contain all transactions concerned with lists of stocks, trading sessions, status of stocks and the trading data,
- private messages are defined in the specification of BSE and in this group we can find transactions which could contain next contents: header, order, sales agreement, cancels of sale agreement, trading blocks, order cancels, order replaces and the book of orders.

BSE has 80 members (15 of them are banks) and they worked together in the processes of testing and implementation, and changing the classic application with the new, FIX application through the gateway in BSE. The installation of the FIX application was strictly scheduled and performed in 2007. Testing process was organized in 4 phases: connection tests, tests of FIX sessions, tests of FIX applications and integration tests, based on processes created by Global Fixed Income Committee, as a result of cooperation of their technical and business subcommittees.

During this process of implementation BSE organized communication with all the relevant entities in this process: members of BSE, software vendors, working group for implementation of FIX protocol in Serbia, FIX Organization – Sector for Europe and the experts (Working Group for Implementation of the FIX Protocol, 2007, pp. 100-104).

The change of the trading system of the BSE brought about changes in the information system so that the existing site is being replaced by a new one, which is visually identical to the former, but the key difference is that the data for the latter are generated via the FIX protocol. It has been planned that, by the end of the first quarter of 2008, all BELEX.info service users get the new version - BELEX.profesional, based on the FIX protocol. BELEX.profesional should considerably improve the characteristics of the current system.

Before the BELEX.FIX trading system was launched, the existing BELEX.info system was used and some preparations for a new version of the BELEX.info application to the FIX protocol were being made and some other functions added: the five-level market depth presentation, an opportunity to observe trading in 60 selected securities during a chosen period.

5. Conclusions

Though the system currently in use can satisfy market needs at this point – in order to increase the security and speed of information exchange, the Belgrade Stock Exchange is developing further the market organization and trading system by introducing a new trading system based on the FIX protocol. The introduction of the Protocol ranks the Belgrade Stock Exchange, in terms of technology, among well known world stock exchanges, and gives domestic brokers an opportunity to operate within a wider framework, increase the number of clients and trading orders, and thus raise the quality of the entire market.

Positive effects of this new solution are multiple, both for individual participants and the entire financial market. Being the latest and the most widely spread protocol on capital markets, through the world the FIX protocol is seen as an imperative to go on with the capital market development in Serbia, because one of the conditions for foreign investors to invest is the creation of environment similar to those in their own countries. Furthermore, the financial market itself becomes more efficient and reliable.

Positive effects for the BSE itself are expected to include: an increase in the number of transactions as well as the whole operating volume; a more quick response to all requirements of users due to the Protocol's flexibility and comprehensiveness; risk management; a rise of the system stability, control, and efficiency; and conditions for faster and more simple implementation of new technologies and solutions.

Positive effects for the brokerage itself are expected to include: a rise in trading reliability and decrease of mistakes or errors, as a user's order is received electronically; much more time for other assignments; expenses cut due to the reduced manual work, errors or mistakes; a higher degree of adaptability of the independent IS to own needs; a more efficient distribution of trading information to the clients, which enables a quick and accurate way of monitoring particular development phases.

Buyers and vendors may experience positive effects including: an efficiency increase in operations control in the trading process, especially in order recording and report receiving; a rise in the speed and efficiency of order-recording, which implies lower costs and errors; better inter-connecting, a higher degree of transparency and economy.

To use the above mentioned advantages to the hilt, some essential preconditions are to be fulfilled. One of them is the creation of an adequate legal framework which will appropriately follow the established standards and trends in the securities industry. It has been accepted that, in the course of the first (transitional) phase of the FIX protocol implementation, it be used without any serious legislative changes. In the second phase, the existing regulatory framework should be up-to-dated and suited to the needs.

The second prerequisite relates to a need for further technological improvements and standardization in this field. With respect to the said, a transition to the gateway concept is of a vital importance, as well as an independent development of the IS of the BSE, and other market participants.

Finally, it must be taken into account that further development of the capital market of Serbia will depend on available market material, which only partially depends on legal, operational, and technological solutions. By introducing the FIX protocol in its trading system, the Belgrade Stock Exchange has secured all required prerequisites to attract foreign portfolio investors and a better position itself in the process of regional integrations.

This paper brings a data mining approach to preserving privacy by trying to aggregate query keywords into clusters. Future research will go into direction of multiple clustering memberships. This means that based on the classes which are similar, a user can be included into several clusters.

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