

Market Information Systems based Reporting

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Abstract. Enterprises operate in markets by building and realizing exchange relationships. Currently, accounting information systems are organized in an enterprise-specific way. We introduce a Market Information System perspective on top of Exchange (Shared Ledger) and Enterprise-Specific perspectives. The two latter developed earlier, are enhanced and their interplay with the Market perspective is elaborated. This paper presents a summary of this model and discusses some of its practical implications, and potential reporting quality improvements.

Keywords: IFRS, UFO, COFRIS, Market Information System

1 Introduction

Relevant and faithful Financial [1-3], Tax, Integrated, National Accounts [4], and other Economics' related Enterprise and Person Reports and Registers play an important social role for decision making. Enterprise Reporting is mainly based on observing the enterprise-specific effects of economic exchanges - transactions¹ on assets and liabilities, captured in Enterprise Information Systems (IS).

In a modern environment, reporting can be increasingly based on neutral, more objective and informative data about transactions within shared ledger and market information systems. In return, the latter can benefit from enterprise-specific information. Such interactions require a common ontology for interoperability. The ontologies of reporting can gain after their reconsidering from a broader than enterprise perspective.

This paper continues the attempt to conceptualize enterprise reporting based on a wider than before [5, 6, 20] perspective, maintaining its grounding in the UFO foundational ontology [9], its subontologies [10-15] and OntoUML modeling tool [8]. The results of this research are expressed in machine-readable OntoUML diagrams and axioms. The main sources are the conceptual frameworks and standards of reporting, such as [1-3], and the cases of their application. The ontology is aimed towards aiding reuse, understandability, intra-consistency, and interoperability, as well as aligning the reporting concepts with economic phenomena frameworks, standards, and other ontologies, such as [17].

Modern reporting is inseparable from its computational Information System. Representation Theory [18] posits that the essential purpose of an IS is to provide a faithful representation of some focal real-world phenomena, thereby assisting its users to track

¹ "or an action within an institutional unit that it is analytically useful to treat like a transaction"
[4]

states and state changes (events) in the phenomena it represents. We emphasize that modern IS increasingly allow the creation of state changes in the real world in addition to just representing them. We distinguish two types of IS for our research: Reporting *Standard-Setting* Information System (COFRIS), and *Standards-Compliant* Reporting Information System that is based on Enterprise IS, Exchange IS, and Market IS.

Economic agents, such as Persons or Enterprises, operate in markets by building and realizing economic exchange relationships. Market participants take part in an exchange as bilateral EXCHANGE PARTIES - a PARTY and a COUNTERPARTY, either directly, or by organizing and facilitating exchange via market (intermediate) agents, and/or using special exchange facilitating resources of other parties, such as online platforms.

We preliminarily refer to MARKET INFORMATION SYSTEMS as information systems of THIRD-PARTIES that transparently to and independently from potential or actual Exchange Parties capture and exchange (communicate) market transaction information, to facilitate or to monitor exchange and reporting.

Independence and transparency here are relative terms – market observation is generally more independent than bilateral, and the latter is more independent than unilateral.

For example, let us regard an independent company (a third-party) that installs and records electricity (or other utility) meters. Via its information system, it discloses to involved exchange parties the measurements (e.g., per hour) combined with market prices observed in the Electricity Exchange IS. Combined information, aggregated per period and per party, represents (constitutes), or is an audit for - the revenue of the involved supplier and the expenses of the involved consumer.

Access to the meter and pricing information, with lower granularity than the reporting period, gives the reporting system the possibility to “drill down” and analyze market and consumer behavior and seasonal patterns as well as explicate unusual events (to determine whether an event is orderly, unique, infrequent, unusual, routine and whether it could have a continuing effect on the routine and frequent business activities of the enterprise [3]). The monthly exchange is concluded by the direct debit of the consumer’s account by the bank in favor of the third-party (for services) and the supplier.

2 Economic Exchange in an Exchange Information System

We assume that an economic exchange involves the exchange of valued resource commitment and transfer actions, as well as the exchange of accompanying information about the involved parties, resources, and experience. The order of the commitments and subsequent transfers can be arbitrary. Being a Party does not mean that it will perform before the Counterparty, nor that we take a perspective of any. Nevertheless, the interaction where the transfer of one party causally depends on the completed transfer of the other party is an important subtype of *synchronized* exchanges in our model.

For reporting and other purposes, economic exchanges are categorized in EXCHANGE STANDARD types (of contracts) and COMMITMENT and TRANSFER RULES, such as for Trade, Lease, Insurance, Financial Instruments, Employee Benefits, and Agriculture.

Most economic exchanges are indirect – mediated through monetary valuation and payments. While payments can take various forms and constitute an equally important part of exchanges, one can often abstract from the payment part for categorization (typification) of exchanges and reduce it to the categorization of obligations and resources.

A major sub-kind of such exchanges are *reciprocal* exchanges in which the transferable resource valuation is equal to the payment (or other consideration) valuation. Non-reciprocal exchanges include gifts, onerous, and option-based transactions [1]. The Exchange phenomenon provides a discrete way of settling a claim, raised by a resource transfer, and includes default.

An ECONOMIC EXCHANGE (see Fig.1) complies to the Exchange Standard and comprises of:

- (1) INFORMATION exchange by potential EXCHANGE PARTIES for building trust and for an economic decision of EXCHANGE of valued resource transfer COMMITMENTS², that results in mutual OBLIGATIONS comprising an EXCHANGE CONTRACT,
- (2) Contract governed EXCHANGE of RESOURCE TRANSFERS and transaction experience INFORMATION.

The processes of Phases (1) and (2) have a similarity of reaching a one-party realization point and two other subphases (not depicted in Fig.1).

The Phase (1) comprises:

- (i) mutual performance of conditional commitment and informative events, while
- (ii) one party accepts or rejects the other party's conditional OBLIGATIONS; if accepted, the party continues with the informative events, while
- (iii) the other party accepts or rejects; if rejected the (ii) is reversed.

When (iii) is accepted, the exchange and obligations are CONTRACTED, and Phase (2) starts. The Phase (2) comprises:

- (i) a BREACH, or mutual TRANSFER for the partial fulfillment of contracted obligations that raise a conditional transfer or performance CLAIM [20] of one party against the other for transferred value, and experience information gain, while
- (ii) one party completes the fulfillment that triggers the mutual resource value exchange and raises an unconditional contract CLAIM against the other party for unfulfilled obligations, and
- (iii) a BREACH, or TRANSFER for settlement of the CLAIM by the other party.

A contracted obligation is a relator because it relates a transfer obligation of one party with a conditional value claim against the other party.

ECONOMIC RESOURCE is a RIGHT (and a relator of a generic HOLDER against a CONVERSE holder towards a TARGET holder) over an OBJECT that has the disposition to produce economic benefits – value claims against the other party.

Economic TRANSFER (Provision) event transfers VALUE, and either conveys the Rights (Obligations) over an Object or the usage (provides service) of such Rights, from the Transferor to the benefit (sacrifice) of the Transferee. When the transfer action becomes substantive and requires recognition and measurement as a resource, it becomes a service itself. A TRANSFEROR is one exchange party who initiates a transfer to the other exchange party – a TRANSFEREE while a Transferer is an agent who executes the transfer.

² Commitment – “making or accepting of a right, obligation, liability, or responsibility by a Person that is capable of enforcement in the jurisdiction in which the commitment is made” [17], thus an event in contrast to its further use as a mode (obligation) in [17] and in [10].

Similar concepts are introduced for Economic COMMITMENTS (Promises), PROMISORS, and PROMISEES.

The exchange of commitments and transfers can be performed by an agency or facilitated by platforms of commitment and transfer parties. The exchange parties can play the roles of the COMMITMENT and TRANSFER PARTIES by themselves and organize the exchange in their own Information Systems that may be shared. We will refer to such systems as EXCHANGE IS. When an exchange is organized by an independent Third-Party either through an AGENCY or PLATFORM, we will refer to such systems as MARKET IS and will regard them in the next section.

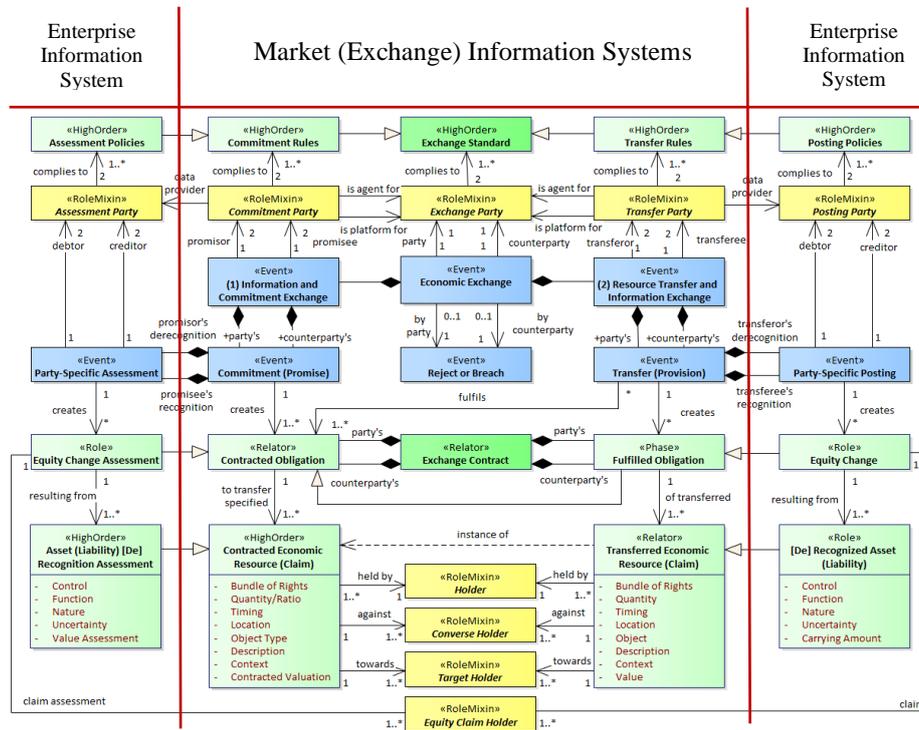


Fig 1. COFRIS. Economic Exchange. Legend: (as in color mixing) Economic agent roles in yellow plus their Actions in blue yield Economic relators in green, that are dispositions of Actions.

During Information and Commitment Exchange, parties exchange information about themselves, the Exchange, Resource and Object types that they commit for exchange. After mutual acceptance, the reciprocal obligations of resource transfer constitute an Exchange Contract.

For each commitment, each exchange party in the role of the ASSESSMENT PARTY within their ENTERPRISE IS, in compliance with its ASSESSMENT POLICIES, performs Assessment of Asset (Liability) type and resulting Equity Change. The promisor as a potential DEBTOR assesses what asset type will be derecognized and which expense type and valuation will be used. The promisee as the potential CREDITOR assesses what asset

type will be recognized and which income type and valuation. (Posting) Assessments and Postings can be specified in a Debit/Credit notation.

During Economic Resource Transfer and Information Exchange, parties FULFIL their Contractual Obligations by transferring Economic Resources of a SPECIFIED TYPE. EXPERIENCE about the participants, transaction, resources, and objects is mutually accumulated, particularly in DESCRIPTION and CONTEXT attributes of the Economic Resource.

For each transfer, each exchange party in the role of a POSTING PARTY within their ENTERPRISE IS, in compliance with its POSTING POLICIES, performs the posting of Asset (Liability) Derecognition/Recognition and resulting Equity Change. The transferor as Debtor derecognizes the asset and the resulting expense type and valuation. The transferee as Creditor recognizes the asset and the resulting income type and valuation.

Note that not only Economic Resources, but also Contracts and Economic Claims (Economic Resources of holders other than the transferor) can be transferred. For example, an Enterprise can settle income tax obligations of an Employee in exchange for the settlement of Employee's payroll claims against the Enterprise.

In contrast with [17], which states that the concept of a claim "is more a matter of business custom than ontological completeness", we regard ECONOMIC CLAIMS as present enforceable obligations to transfer as a result of past value receipts and *other events*. Indeed, the quantity, value, and other features of the present claims and resources of an enterprise are not determined by the exchanges exclusively, but also by impairment and market valuation and resource type changes and other economic events.

For Standards-compliant Economic Exchanges, in concert with [2, para 4.30], stating that "If one party has an obligation to transfer an economic resource, it follows that another party (or parties) has a right to receive that economic resource", we assume the following:

- the required information captured about an Economic Exchange by one party is correlative and consensual to the information captured by the other party, including verified statuses and the "related-to" relationship of the parties and exchangeable resources. The Exchange IS that captures such information provides an independent perspective as well as each party's individual view of this information. COFRIS provides an independent perspective for financial reporting standards and individual view for each party.
- In a shared perspective, reporting is based on aggregating (over a particular enterprise) of shared Economic Exchanges. Commitments and transfers have assessment and posting events as subevents. The Exchange IS governs and prompts the following mapping of the initial assessment/posting events:
 - each assessment/posting event references the commitment/transfer event,
 - each asset (liability), even if only momentarily, is an enterprise specialization of a resource (claim), and
 - each assessed or posted income (expenses) or equity change is an enterprise specialization of a contracted obligation or an exchange type.

Recognition and measurement, taking the forward-looking perspective of an Enterprise, specialize Economic Resources (Claims) into Assets (Liabilities) taking into account Capabilities, Restrictions, Synergies, Uncertainty [1], and Functions of the Enterprise.

E.g., Raw Materials for Construction Department are a specialization (purpose) of ‘Common Bricks’ as Resources in a purchase transaction.

Derecognition generalizes Enterprise Assets (Liabilities) into Market typified and evaluated Resources (Claims). E.g., Finished Products of Production Department (source) are generalizations of ‘Common Bricks’ as Resources in a sales transaction.

ISO/IEC 15944-4:2015 [17] reasonably denotes the enterprise-specific perspective as a “trading party perspective” and exchange perspective as an “independent perspective”. Further, it claims that ‘For internal database purposes of corporate accountability, “trading partner perspective” terms are directly derivable from “independent perspective” terms’.

In contrast, the Conceptual Framework for Financial Reporting, prescribing corporate accountability in [2, para 4.30], postulates that “a requirement for one party to recognise a liability and measure it at a specified amount does not imply that the other party (or parties) must recognise an asset or measure it at the same amount. For example, particular Standards may contain different recognition criteria or measurement requirements for the liability of one party and the corresponding asset of the other party (or parties) if those different criteria or requirements are a consequence of decisions intended to select the most relevant information that faithfully represents what it purports to represent.” Indeed, the decision acts of derecognition/recognition, initial classification, and initial measurement are dependent but additional to those of the transfer/receipt.

Immediate expensing, accumulating, or capitalizing of the received resources as well as their recovery function, nature and valuation within an enterprise are its prerogatives. However high level of required categorization by FR often allows for an inference of the element types from transaction purpose and location, exchange lifecycle categorization, and business model and policy of the enterprise. Moreover, assets and liabilities of the enterprise often continue to be tied to the supplier (and of course debtor and creditor) within warranties, maintenance, and lease agreements. The categorization, lifecycle, and valuation of elements are often tied to the market.

The question requiring further research is whether such inferences should be used, required and disclosed in shared transaction recording. A separate issue is the disclosure of the resource sourcing and cost.

ASSET is a present Economic Resource controlled by the Enterprise as a result of past events [2]. LIABILITY is a present obligation of the enterprise to transfer an Economic Resource (of a specified type) as a result of past events, including operating in a particular market. EQUITY is the residual interest in the assets of the Enterprise after deducting all its liabilities [2], and an Equity Holders’ (Owners’) Claim against Enterprise. The most basic EQUITY CHANGES are Income and Expenses.

3 Economic Exchange in a Market Information System

Most exchanges are committed and realized in the market environment and through some Market Information Systems maintained by Third-Parties, having service Contracts/Terms of use with the exchange parties. Third-Party contracts are subtypes of Resource exchange contracts that should be contracted before the commitments and transfers are enabled and facilitated by them.

Let us return to Fig.1 for a more detailed perspective of an Economic Exchange in a market. The basic exchange is enabled by the commitment and transfer parties being in an AGENCY³ relationship with an exchange party, which are exchange parties themselves, or Third-Parties that exchange on behalf of the parties being their agents, such as employees, or parties being agents, or independent agents with their own Information Systems.

The basic exchange is facilitated by commitment and transfer parties being in an online PLATFORM⁴ relationship with an exchange party, which means that the Third-Party provides an Information System Resource that helps the exchange party to carry out the actions of the exchange including smart contracts.

Markets are institutions in which human or institutional agents exchange valued Economic Resources. The concept of Markets and thus Market IS, however, is wider than the concept of exchange because it includes the structural macro-effects that result from a large number of exchanges, for example, changes in the overall price level, exchange, participant, resource, and object provenance and typification. The ultimate location of the Market IS is the net (cloud). The market is a truth-maker of a product and thus involved resources.

Market IS emerge when they provide exchange, resource, object, and participant matching, typification and valuation of substantial impact. The goal of the Market IS is to be better off by facilitating a substantial network effects, in contrast to Exchange IS that facilitates partner relationships, and Enterprise IS that have a minimal goal of arm's length transactions.

Market IS services can be provided in both – commitment and resource exchange phases. The service and possibly other resources are provided to both parties and evaluated separately, according to their contracts with Third-Party. Through Market IS the information is shared with all participants.

Market IS usage does not necessarily imply financial agreements. A Third-Party may collect transaction fees indirectly through the provision of marketing information, or collecting data about parties and their behavior, exchanges, resources, prices and then monetizing this data.

Often service fees are not accrued at commitment exchange but collected in a payment transaction for the whole exchange process.

Note that in the OntoUML diagrams Events have BEGIN and END points as properties and are past occurrences [12]. Thus, the Fig. 1 shows the situation after the events have already taken place. Substantial information about the exchanges can be depicted in a form of the correlative and consensual effects of their lifecycle events.

³ Sometimes one party (a principal) engages another party (an agent) to act on behalf of, and for the benefit of, the principal. If an agent has custody of an Economic Resource (ER) controlled by the principal, that ER is not an Asset of the agent. Furthermore, if the agent has an obligation to transfer to another party an ER controlled by the principal, that obligation is not a Liability of the agent, because the ER that would be transferred is the principal's ER, not the agent's. [2, para 4.25]

⁴ An online platform is defined as a digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the Internet. [19]

Further, in this paper, economic exchanges will be represented as potential or actual contracts with “bound to” exchange parties, and contractual obligations of the exchange parties in different phases of fulfillment, as well as the related (posting) assessments and postings (see Fig. 2).

The direction of the relation between a party and a contract shows whether the party is a seller (incoming arrow), a buyer (outcoming arrow), or is undefined.

The direction of the relation between obligations of a specified party and a contract shows whether the fulfillment of these obligations causes contract realization/settlement (incoming arrows), or these obligations become claims/fulfilled after the contract realization/settlement (outcoming arrows) or is undefined.

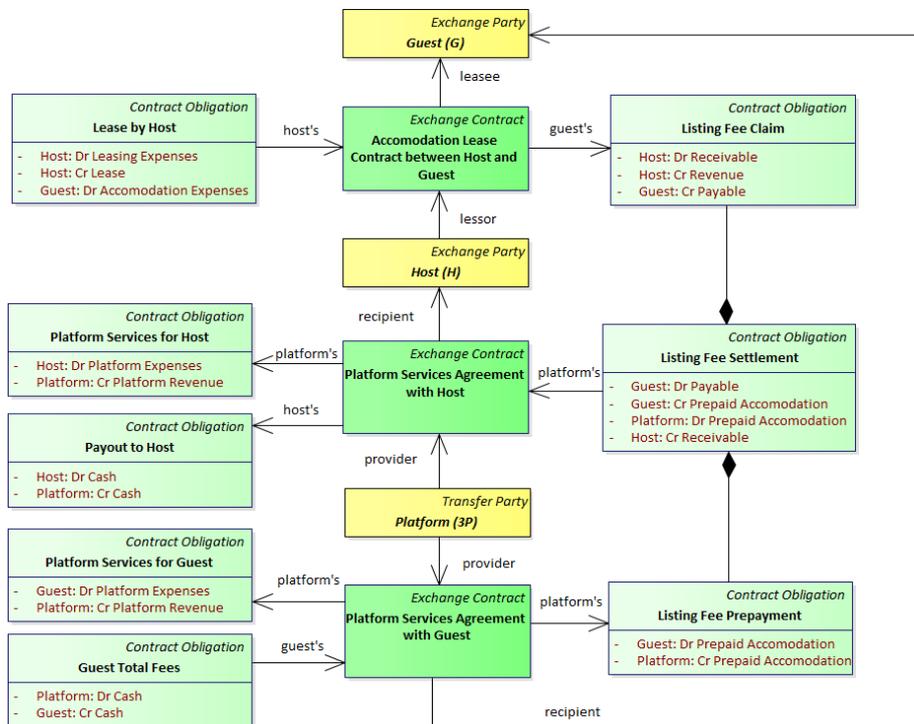


Fig. 2. COFRIS. Exchange Standard Parties, Contracts, Obligations, and Postings (shown as attributes in a Debit/Credit notation, separately for each party) in a Market IS example.

In Fig. 2 we have shown complex Standard Exchange participants, contracts, obligations, and postings in an Airbnb⁵ like Platform IS provided by a company 3P for illustrative purposes.

In this simplified illustration, the depicted Standard Exchange leads to the following happy-path scenario. In phase (1), after (i) publishing and searching of accommodation listings by Members (Guests and Hosts), (ii) the Guest G accepts by booking request,

⁵ <https://www.airbnb.com/>

and (iii) the Host *H* accepts or rejects⁶. If rejected, the (ii) is reversed. If accepted, the GUEST TOTAL FEES are collected through the Platform's Payment Service which is an Agentive part of its Platform Services (i.e. the *3P* is an agent). Total Fees are allocated towards GUEST FEE for Platform Services and LISTING FEE PREPAYMENT.

Per SERVICES AGREEMENTs with exchange parties, the company *3P* by providing its Platform Services has facilitated and captured in its Market IS the matching (Commitment Exchange) between the Host and the Guest, resulting in their ACCOMMODATION LEASE CONTRACT.

Furthermore, in phase (2), (i) and (ii) - The Host realizes a complete lease (a revenue) for the Guest, that rises an unconditional LISTING FEE CLAIM (a receivable). (iii) Per Service Agreement with the Platform the Claim is exchanged for HOST FEE for Platform Services and PAYOUT TO THE HOST, taken from the Guest's Prepayment. Members exchange reviews and ratings – experience information – within Market IS. All three parties [de] recognize their exchanges as Assets'/Liabilities' and Equity changes in their Enterprise IS.

4 Discussion and Conclusions

Market IS together with coordinated Enterprise IS provide the most faithful, relevant, comparable, verifiable, timely, understandable, and less costly information for financial and other reporting. The abovementioned qualitative characteristics are defined in [2] as fundamental and enhancing for financial information.

Faithfull information should be complete, neutral and free from error. All transactions of an enterprise facilitated through a Market IS should be reported thus ensuring a higher level of completeness. Higher neutrality and error minimization is achieved by a three-way consensus about the information captured in the Market IS. The information gathered is additionally enriched by multiple participants' experience and context.

Relevant financial information is capable of making a difference in the decisions made by users. It has predictive value and/or confirmatory value. First, an aggregated Market IS information is relevant by itself – an investor can understand how a particular market or product performs. Second, for an enterprise, the full exchange lifecycle information allows for better confirmability and predictability, particularly because all unaccepted offers and other cancelations are captured. Third, Market IS facilitates assessments by similar transaction and price information comparison.

Comparability with similar information about other enterprises and with similar information about the same enterprise for another period or another date is facilitated by Enterprise and Market transaction history. The vast amount of transactions of even millions of enterprises are captured by a particular platform in the same data format, involving objects of the same type and shared meaning that allows for unprecedented comparability among different enterprises and time periods.

⁶ In the U.S., Airbnb hosts had rejected more than 40% of guests' reservations in recent years.

Verifiability means that different knowledgeable and independent observers could reach consensus, although not necessarily complete agreement, that a particular depiction is a faithful representation - the Market IS transactions are at least in a three-way consensus.

Understandability Classifying, characterizing and presenting information clearly and concisely makes it understandable – the Market IS transactions are understood at least in three-ways, but transaction types by two large market groups and a Third-Party.

Cost constrain - providers of financial information expend most of the effort involved in collecting, processing, verifying and disseminating financial information. Reporting financial information imposes costs, and it is important that those costs are justified by the benefits of reporting that information – these and other costs are reduced due to Market IS. Of course, the count of the transactions increase exponential and more compared to the aggregated reports count of enterprises. However, the transactions are captured within the enterprises anyway and that at least triples the count, besides that the transaction information can be aggregated over three parties. Of course, the ability of an FR system to process the aggregated transaction information is a serious threshold for a full implementation.

In addition, the Market IS provide fast regulation responsiveness to market experience, typification, and provenance of economic exchanges, market participants, resources and claims, their valuation and underlying objects. Market IS are objective and especially objective if they provide for independent exchange facilitating services and payment agencies.

Since the Market IS facilitates and executes an exchange parties' actions, it also can restrict them to comply to general and platform rules. Restrictions are also built in Enterprise IS, but again they can be less objective and more manipulated than in the Market IS. In addition, a Market IS it can sanction or escalate, if such rules are violated.

However, Market IS based reporting is challenged by many problems, such as information disclosure, legislation and reporting standards, information processing resources. Nevertheless, many current activities, especially in tax reporting trend towards the right direction.

So, several platform companies including Airbnb [16] have opened or required access to their data for tax authorities. Similarly, banks, e-health systems, POS terminals share transaction information with authorities. Companies, in general, provide VAT, payroll, and building companies even timesheet information on a regular basis or on-demand. Registers of companies, transaction histories involving many resources such as drug provenance, motor vehicle registration, and claims, are public.

Another evidence is the emergence of contract preparation platforms. Recently several leading mobile providers in Russian Federation have announced such systems - "The ecosystem of the Digital Lawyer includes the "Document Designer", which works on the principle of a neural chatbot in the web interface. The necessary information is collected through dialogue with the user, and a finished document is obtained at the output", in addition, a service is offered for integration with accounting or ERP systems.⁷

Our proposal is not - "open ledger for everyone" (nor even for Reporting authorities). To start with Market IS Reporting one only needs to know that the transactions reported

⁷ https://www.cnews.ru/news/top/2020-01-29_novyj_servis_megafona

are marked as consensual, correlative, and marketed, and output derecognitions and input recognitions (in contrast to internal postings) are in sync with the transfers and with the lifecycle.

Factors that affect the relationship between Transaction and Posting information is a topic for our future research.

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