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For Peer Review Only

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Transforming Traditional Production System Transactions to Interoperable eBusiness-aware Systems with the use of Generic Process Models

Through the years, successful enterprises have been identified as the ones that were able to adapt their processes and ways of conducting business to the needs of their environment and the technological achievements of their times. This statement has not changed during the last years, but today, due to the major breakthrough of the Internet and the possibilities it offers for a unified electronic marketplace, enterprises have to take advantage of the new technological tools offered, in order not only to adapt to this new emerging environment, but also to benefit from it and expand their operations in parallel with minimising costs. Achieving interoperability of the various production systems, and not only enabling hard-wired connectivity, seems to be the key that will unlock the gates leading to this newly established global market, and therefore enterprises need to focus more on their already established processes in order to be able to formulate a global standard for executing business transactions and co-operating smoothly with each other.

Keywords: System Interconnection, eBusiness interoperability, Modeling cross-enterprise business processes, Enterprise modeling for interoperability, Meta-data and meta-models for interoperability

1. Introduction

During the last years a substantial technological progress in the area of eBusiness has been recorded, as systems have moved from monolithic applications, serving just the internal needs of an enterprise, to expandable and modular applications and services that are in a position to satisfy also the external needs of each organisation. Especially in the 90's and in the 00's, the need of interconnecting business and conducting co-operative activities, has resulted in the creation of various solutions for interlinking business systems, either by hard-wiring specific capabilities in those systems or by adopting legacy standards for document exchange.

In today's rapidly evolving world, enterprises need to adjust their business models constantly to changes in their environment (Weiss and Amyot 2005). However, despite the reality of eBusiness evolution, the adoption of new internet-based technologies in the business environment is still limited, especially in the sector of small and medium (SMEs) or very small enterprises (VSEs) (Androutsellis-Theotokis et al. 2005) and most of the efforts were until now targeting more at

1
2
3 Business-to-Consumer (B2C) and at Business-to-Business (B2B) transactions which
4
5 involve only businesses of same interests, as various barriers, of economical but also
6
7 of technological nature, are still present (Jones, Beynon-Davies and Muir 2003).
8
9

10 Although this approach is a significant step for the SMEs towards a full electronically
11
12 managed and operated business schema and the advantages of this approach are multi-
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14 fold and can be measured in reduced working times and eventually in minimizing
15
16 expenses while increasing earnings, the limitation of focusing on the aforementioned
17
18 domains is a significant drawback to the operation and future development of these
19
20 enterprises. The reason behind this is the nature of the new emerging era of a unified
21
22 marketplace, with no boundaries, nor geographical neither in business domains, as the
23
24 operation of an enterprise in this newly established environment constitutes a crucial
25
26 factor for its survival and its development.
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32 This paper addresses this very specific issue, which is no other than providing
33
34 a methodology and a set of initial unified business processes in order to satisfy the
35
36 needs of businesses for co-operating and executing transactions in a unified
37
38 environment, regardless of the nature of each business partner.
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41 Enterprise Modeling is the art of externalizing enterprise knowledge, i.e.
42
43 representing the enterprise in terms of its organisation and operations (e.g. processes,
44
45 behaviour, activities, information, object and material flows, resources and
46
47 organization units and system infrastructure and architectures) (Ruggaber 2006,
48
49 Vernadat 2007). Its main goal is not only to be applied for better enterprise integration
50
51 but also to support the analysis of an enterprise, and to represent and understand how
52
53 the enterprise works, to capitalize acquired knowledge and know-how for later reuse,
54
55 to design (or redesign) a part of the enterprise, to analyze some aspects of the
56
57 enterprise, to simulate the behaviour of the enterprise in various environmental cases,
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3 to improve the decision making mechanisms of the enterprise, or to control,
4
5 coordinate and monitor some parts of the enterprise. As such, enterprise modeling
6
7 plays a protagonistic role in eBusiness as the medium facilitating the design of
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9 interoperable systems and architectures, based on the already established mechanisms
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11 and procedures of the different transaction parties.
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15 The research area of this paper comprises of Business to Business (B2B),
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17 Business to Government (B2G) and Business to Institutions (B2I) –such as Banks and
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19 Public Insurance Institutions– transactions between Business, Governmental and
20
21 Institutions of different countries (cross-border) or of different interests/operation
22
23 domains (cross-sector).
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28 **2. Developments in Enterprise Modeling towards eBusiness interoperability**

29 Interoperability as a driver for e-transactions constitutes a challenging field where
30
31 scientific advances are very often accompanied by noteworthy benefits for the
32
33 adopting stakeholders. According to Gartner ICT (Gartner 2007) interoperability
34
35 products alone constitute a thriving market that surpasses 200 M€ per year worldwide.
36
37 The underlying state of the art appears to be quite progressed, incorporating from
38
39 methodologies, frameworks and standards for process, data and service integration to
40
41 commercial of the self solutions and integrated platforms for e-transactions. (Gionis et
42
43 al. 2008)
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48 Although enterprise modeling spans over the whole domain of an enterprise
49
50 and it can refer to all the available assets (processes, documents, roles, systems,
51
52 infrastructure), in this paper the focal point is on the processes perspective, as it is the
53
54 most essential part that needs to be tackled when talking about interoperability.
55
56 Currently the field in enterprise modeling comprises various enterprise frameworks
57
58 and architectures (Zachman, Generalised Enterprise Reference Architecture and
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3 Methodology (GERAM), GRAI Integrated Methodology (GRAI/GIM), ARIS,
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6 Computer Integrated Manufacturing Open System Architecture (CIMOSA),
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8 Department of Defense Architecture Framework (DoDAF), The Open Group
9
10 Architecture Framework (TOGAF), Treasury Enterprise Architecture Framework
11
12 (TEAF), etc.) and a large number enterprise modeling languages (Unified Modeling
13
14 Language (UML), Business Process Modeling Language (BPML), Unified Enterprise
15
16 Modeling Language (UEML), etc.). As a result, several approaches emerge today,
17
18 each one selecting its own path, with the objective to assist the integration process of
19
20 business partners and to provide them with capabilities that will enable e-transactions.
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24
25 The adoption of Extensible Markup Language (XML) can partially solve the
26
27 problem of lacking a common language and the creation of standards can quite easily
28
29 crack the issue of data differentiation (Rodgers et al. 2002). However this solution
30
31 requires enterprises to use the same processes, which is not the case in the real world-
32
33 wide marketplace.
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36
37 The innovation of eBusiness XML (ebXML), a language aims at defining
38
39 protocols, security mechanisms, architecture, and business process models is another
40
41 option to be taken under consideration, although many feel that the approach of
42
43 having a committee designing a software standard are doomed, as it is almost
44
45 impossible to co-ordinate the creation of a comprehensive set of guidelines when
46
47 having a user community of millions of users with unique (Costa 1999, Gomes 2000).
48
49

50
51 As Ou-Yang and Lin (2008) very well state, most of the above mentioned
52
53 tools and technologies, although quite suitable for the modellers or users with pre-
54
55 request background such as XML and UML, fail to communicate with the ordinary
56
57 user regarding the constructed models that have to be developed and therefore the use
58
59 of graphic notations such as the Business Process Modeling Notation (BPMN) is
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3 suggested in order to bridge this gap of misunderstanding between technicians and
4
5 managers.
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8 However, the economic issue of adopting such solutions and platforms that
9
10 exist is difficult to overcome, especially in the case of SMEs, since the cost of
11
12 implementing these new technologies, is always high and time consuming specially
13
14 when the enterprises have already established solutions which are serving their needs
15
16 quite satisfactory. So the main challenge lies in implementing interoperable systems,
17
18 based on the existing legacy systems by minimizing the transformation of the existing
19
20 business process of an SME in order for it to enter the eBusiness community; failing
21
22 to respond to this challenges will result to the emerge of an instant competitive
23
24 disadvantage, as the enterprise's growth horizon will be restrained.. The answer to
25
26 this issue seems to be hybrid architectures, based on adaptors interconnecting the
27
28 various legacy systems by executing pre-defined and standardised generic business
29
30 processes supported by commonly agreed data elements and business rules. As a
31
32 result, a methodology is required for modelling the various business transactions in
33
34 order to create a global business processes that will allow the smooth and
35
36 unproblematic execution of eBusiness transactions between different organisations.
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43 44 **3. A Hybrid approach for a unified electronic marketplace**

45 Interoperability is defined as the ability of two or more systems or components to
46
47 exchange information and to use the information that has been exchanged (IEEE
48
49 1990). Nowadays, when talking about interoperability, the definition is shifted more
50
51 to the latter statement as business have realized that the benefits lie not in bi-
52
53 directional interoperable systems but in multi-node connections, e.g. being able to
54
55 connect, access and seamlessly co-operate with multiple systems. As a direct result,
56
57 achieving interoperability is considered as the key factor which will drive eBusiness
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3 to the next level by offering fully automated transactions that will be carried out
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5 without the need of any further actions; it will indicate the final adoption of eBusiness
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7 in heterogeneous business domains (cross-border / cross-sector business domains).
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9 However having multiple specifications that overlap and describe similar features can
10
11 cause interoperability problems (Aissi 2002) and the challenge lies in picking globally
12
13 accepted standards for implementing common business process models that will build
14
15 the unified electronic transactions environment of the future. Therefore,
16
17 interoperability stand as a key-word in the present information system's agenda, with
18
19 the creation of a global electronic environment being a strategic issue, so that
20
21 enterprises can raise their collaboration and gain competitiveness in the global market.
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27 According to Gartner (2007) monolithic, centralized architectures that focus
28
29 only within the enterprise, and not on business partners and customers, are worthless.
30
31 Modern enterprises in order to respond effectively and swiftly to competitive
32
33 challenges are obliged to streamline both internal and external business processes by
34
35 integrating the various packaged and home-grown applications found spread
36
37 throughout an enterprise (Papazoglou and Heuvel 2007).
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41
42 Towards facilitating such issues and proposing interoperability solutions that
43
44 involve enterprise application integration and interconnection (Charalabidis et al.
45
46 2004) numerous research projects have been funded, aiming at providing solutions in
47
48 the key area of electronic transactions. Proportionally, the Enterprise Interoperability
49
50 Research Roadmap (Li et al. 2006) defines the concept of interoperability service
51
52 utility to denote an overall system that provides enterprise interoperability to its users
53
54 as a utility-like capability in a "plug-n-play" way.
55
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57
58 Amongst these projects, GENESIS (2005a) (Enterprise Application
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60 Interoperability – Integration for SMEs, Governmental Organizations and

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2
3 Intermediaries in the New European Union), a project funded in the context of the EU
4 Framework Program 6 (FP6) with its main goal being the research, development and
5 pilot application of the needed methodologies, infrastructure and software
6 components that will allow the typical, usually small and medium, European
7 enterprise to conduct its Business transactions over Internet, tried to facilitate the
8 interconnection of the main transactional software applications and systems of
9 collaborating enterprises, governmental bodies, banking and insurance institutions
10 with respect to the EC current legal and regulatory status and the existing one in the
11 new EU, candidate and associate countries (GENESIS 2005b).
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24 The proposed architecture that derived from this project is based on the
25 concept of using software adapters for interconnecting already established enterprise
26 business systems, as a way to minimize development costs and to preserve the
27 enterprises investments in IT. The interconnection of the different transaction parties
28 is carried out using peer-to-peer connectivity mechanisms powered by a centralized
29 supportive infrastructure, as depicted in Figure 1. Following this approach, the
30 proposed architecture is serving the need for the direct exchange of business
31 documents between the different transaction partners through the provision of
32 customized service workflows and data mapping schemas that is the responsibility of
33 a central instance server.
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48 Three different components – the repository, the server and the adapters – are
49 collaborating together in order to establish the integration platform that enables
50 stakeholders of heterogeneous nature (enterprises and administrations) to engage and
51 sustain networked enterprise paradigms based on dynamically composed, end to end
52 integrated services. The repository stores semantic information about the
53 characteristics of the transaction entities in the form of models about the processes,
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3 corresponding service endpoints and data models and even higher level models of
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5 business and legal rules.
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8 The server acts as the integrating component among the transaction parties,
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10 providing them with the necessary capabilities to engage in e-transactions directly
11
12 among themselves. Specifically, for every transaction the server makes use of the
13
14 information in the repository in order to synthesize specific generic process models
15
16 and extract the corresponding workflow based on the process models and the existing
17
18 service endpoints supported by the interested parties and also provides specific data
19
20 mappings based on the underlying data models of the partners to enable the
21
22 transformation of business documents. Last but not least, the adapter (one at each
23
24 transaction endpoint) provides the technical capabilities for the direct exchange of
25
26 information among the parties, as it is possible to execute dynamic workflows,
27
28 perform document transformation and exchange data within each party's operational
29
30 boundaries by calling the supported externalized service scripts.
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37 **4. Process Evaluation Framework and Methodology towards Business Process** 38 **Modeling**

39 ***4.1 Formulating an Initial "Core" Transaction List***

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41 The proposed methodology targets all national and cross-country B2B, B2G and B2I
42
43 transaction of the European marketplace and was designed to incorporate all the
44
45 aspects of such processes. However, due to the huge number of transactions,
46
47 modeling of the complete set of transactions is regarded as an overkill process, as the
48
49 cost of such an action is relatively high, not only in terms of resources required during
50
51 the modeling phase, but also in terms of post-modeling investments that have to be
52
53 placed not only for implementing the necessary software adapters required for the
54
55 system interconnection purposes, but also for any additional business process
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3 reengineering actions that will align the internal business processes to the ones that
4
5 will be defined by the generic unified transactions models.
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9 Moreover, only a small part of the complete transaction set is constantly used
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11 by enterprises and those are mainly transactions that do not only facilitate the
12
13 everyday work of such organisations, but also the ones that return the most profits. In
14
15 this context, the methodology of process modeling is preceded by an evaluation
16
17 framework which serves as a selection mechanism for the transaction to be modelled
18
19 first. In order to identify the most common and important transactions carried out by
20
21 SMEs which can and are worth of being fully automated, an evaluation framework
22
23 has been used. This framework consists of the assessment of the following criteria:
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25

- 26
- 27 • Frequency of use
- 28 • Process execution duration
- 29 • Required Resources
- 30 • Support by IT systems
- 31 • Legal framework interference
- 32 • Degree of importance for the enterprise
- 33
- 34

35 The above mentioned criteria can at a glance justify whether a transaction is worth
36
37 being modelled as a priority. The highest factors like frequency of use, process
38
39 execution duration, required resources, support by IT systems and degree of
40
41 importance for the enterprise (core business transaction or just complementary) score,
42
43 the more importance is placed on a specific transaction, while the degree of legal
44
45 framework interference plays a negative role as the presence of complicated legal and
46
47 statutory rules implies various limitations and barriers that are hard overcome and to
48
49 be homogenized in a hybrid cross-border, cross-sector transaction environment. (Nath
50
51 et al. 1998)
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53

54
55 The application field of this framework was an initial transaction list
56
57 compromising of various transactions from each sector. More specifically, the initial
58
59 B2B transactions were identified with the use of the UBL 2.0 standards (OASIS,
60

1
2
3 2006) for B2B Processes, B2G transactions were identified by studying the i2010 EU
4 policy framework for the information society and media (European Commission n.d.)
5
6 and Interoperable Delivery of European eGovernment Services to public
7
8 Administrations, Businesses and Citizens (IDABC 2004) Initiatives and B2I
9
10 transactions were identified by studying financial exchange standards like Open
11
12 Financial Exchange (OFX 2006). The criteria of all the above mentioned transactions
13
14 were evaluated by enterprises in different countries and finally used as input in an
15
16 ELECTRE III multi-criteria decision making system Roy (1978) that resulted to a
17
18 classification table, ranking the processes based on their modeling priority.
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25 ***4.2 A Methodology towards Process Modeling***

26 Enterprise Modeling techniques and associated visual languages are very important
27
28 and useful to support new approaches to enterprise business transformation and
29
30 improvement, developing smart organizations and new networked organizations, as
31
32 they can visually represent these models and offer them to business analysts, IT
33
34 designers or high level personnel in a comprehensible manner which is
35
36 understandable by all (GENESIS 2008)
37
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41 In the GENESIS Project, the enterprise modeling activities contribute to the
42
43 resolution of organizational interoperability aspects. According to the European
44
45 Interoperability Framework (IDABC 2004), organizational interoperability “is
46
47 concerned with defining business goals, modeling business processes and bringing
48
49 about the collaboration of organizations that wish to exchange information and may
50
51 have different internal structures and processes.” The key to solve this Gordian knot is
52
53 to identify and document the “Business Interoperability Interfaces” through which the
54
55 communicating parties will be able to interoperate at national and cross-country
56
57 levels.
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3 As numerous process modeling methodologies, languages and frameworks are
4 present, modellers are often troubled with the constant question about the approach
5 they have to choose. Practice has shown that this question is more or less rhetoric, as
6 no specific and objective answer can be given, due to the fact that languages and
7 methodologies have grown in such a way, that they are not only complementary but in
8 many cases overlapping and as such the modelling method chosen has to relate its
9 goals and perspectives to the perspectives from which and the purpose for which the
10 process is conducted (Aytulun and Guneri 2007).
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22 As Aguilar-Saven (2004) states, “using the right model involves taking into
23 account the purpose of the analysis and, knowledge of the available process modeling
24 techniques and tools. The number of references on business modeling is huge, thus
25 making it very time consuming to get an overview and understand many of the
26 concepts and vocabulary involved.” Therefore, despite the proliferation of
27 frameworks and techniques in the enterprise modeling landscape, it depends on the
28 goal of each project to decide which facets have to be taken into account. For
29 example, if the project deals with optimization of the processes, the quantitative and
30 organizational facets will be useful. If there are requirements for process
31 harmonization within a group of companies, then the context-based facet is necessary.
32 As a result, the choice lies clearly on the hand of each modeller, who tries to find the
33 balance point between issues such as the requirement that each different case sets, the
34 target audience who will use and work with the models (e.g. business analysts,
35 consultants, programmers), the expertise he has in the specific methodologies and the
36 research stream and community behind each methodology.
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57 When dealing with heterogeneous domain interoperability requirements, a
58 process modeling methodology has to be able to incorporate the different issues that
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1
2
3 are present in such domains. First of all, the methodology has to be able to deal with
4
5 “Cross-Enterprise, Cross-Sector” processes. This term refers to the ability to support
6
7 transactions of different entities that at the same time belong to environments with
8
9 clear differentiations. Such transactions are the ones between enterprises and
10
11 organisations that belong to the private sector, and the public administration or the
12
13 banking institutions.
14
15

16
17 At a second stage, the methodology needs to tackle successfully the
18
19 characteristics of “cross border” transactions. In other words, the approach that will be
20
21 chosen should possess the ability to manage models representing international
22
23 transactions. Such transactions have their own characteristics and their own
24
25 parameters, which vary among same transactions carried out between different
26
27 countries, as each domestic marketplace differs a lot from all the others (Calori and
28
29 Woot 1004, Boter and Holmquistb 1996).
30
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34 Last but not least, legal issues that are affecting the different transactions have
35
36 to be taken under consideration too. As (Jones et al. 2000) very well states, “the
37
38 explosive worldwide growth of the Internet, its vulnerabilities, and the lack of clear
39
40 legal rules in international ecommerce have raised legitimate concerns with respect to
41
42 the adequacy of consumer protection measures in the online environment”. This
43
44 opinion, although focusing on eCommerce, is also expressing the present situation of
45
46 the eBusiness world too, as no global statutory or legislative transaction framework
47
48 exists, which creates enormous problems in electronic transactions, as the participants
49
50 have to mutually respect the legislation of each other and format their rules and
51
52 documents so that to comply with the other end-parties legal obligations. In this
53
54 context, the methodology needs to be able to deal with and to model at a high level
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3 the various legal aspects which are present in the aforementioned transactions, which
4
5 include also different rules and business documents.
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8 For each one of the transactions promoted by the evaluation framework
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10 described before. a generic process model facilitating interoperability was designed
11
12 using state of the art modeling notations and methodologies (Bussler 2001, ATHENA
13
14 2007, IDEAS 2002). As a result, the methodology succeeds in successfully tackling
15
16 the major issues that arise in case of cross-border and cross-sector transactions. Those
17
18 are no other than the need of generic business process models in order to facilitate the
19
20 workflows, the existence of different rules (either legal or business specific) and the
21
22 heterogeneity of data elements that have to be encapsulated in the exchanged
23
24 documents. In this context, the proposed methodology results in consolidated generic
25
26 process model at an abstraction level that defines the exact process flow, the
27
28 documents and the rules that will apply at each transaction and pushes the
29
30 interoperability matching algorithms to the side of the software adapters, that will
31
32 handle the transformation of the data and the internal procedure calls that will guide
33
34 the process flow.
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41 During the Process Modeling Methodology definition, four different levels of
42
43 process modeling are used, as depicted in Figure 2; the private, the public and the
44
45 collaboration process modeling view (Bussler 2001, Dayal et al. 2001), plus a generic
46
47 view which compromises all the collaboration view models into generic models that
48
49 derive from identified common process patterns that appear in the collaboration
50
51 models. The reason behind this discrimination is the need for building structured
52
53 models that can describe fully a transaction, from the internal enterprise level up to
54
55 the collaboration level between different transaction parties. As such, a bottom up
56
57 methodology is needed, that will address each organisation separately
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3 The Private Process View incorporates the “private processes” of a transaction
4 party, which are inner-organizational processes from the business point of view i.e. an
5 internal process of an organization or an enterprise. Private processes are used to
6 identify the context of how and when certain documents for collaborating with other
7 parties are produced or consumed. These documents act the interfaces for the public
8 process. Such activities usually provide rich information on business rules that impact
9 the process design.
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20 The “Public Process View” is a coarse description of process steps
21 representing the interface of an organization for collaborating with other parties. Only
22 those activities that are used to communicate outside the borders of the enterprise,
23 plus the appropriate flow control mechanisms, are modelled in the public process
24 view. A public process, as seen from the transaction point of view, presents the
25 sequence of messages that are required in order to interact with other parties.
26 Activities of the external entity (i.e. the other collaborating partner) are not described.
27 The public process model for a business partner reveals its corresponding service
28 endpoints for exchanging business documents (Leymann et al. 2002). The documents
29 that are modelled in this view are the specific documents that each organisation is
30 using and the whole process includes specific business rules that apply in each case
31 which may address internal issues or decisions.
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48 The third modeling view, which is called “Collaboration Process View”, is the
49 aggregation of two or more public models of organisations that engage into a
50 transaction. The outcome is the high level model of a transaction that takes places
51 between two organisations, where the internal parts of the processes are grouped in
52 major tasks and thus are hidden and not presented in detail. Only crucial decision
53 points that are affecting the whole transactions are shown and various sub-processes
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3 that are actually modelled as other public models and are triggered at execution time,
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5 according to the flow of the initial flow. This view includes generic business
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7 documents that are mutually agreed between the transaction parties and more generic
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9 rules apply, in order to both comply with the legislation framework of the transaction
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11 and the various business rules of the different parties.
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15 The above mentioned views are defined as national and sector specific. When
16
17 it comes to implement cross-country, different end-users and supporting IT systems
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19 transactions, the variants do not cover the necessary requirements for a generic
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21 representation, but provide insight on specific, narrow representations. Generalization
22
23 and harmonization activities of the specific representation thus need to follow in order
24
25 to lead to a generic representation of each process at the same abstraction level of the
26
27 description elements (processes, rules, and data). In this context, "Generic" means that
28
29 this process is not specific to countries, end users or systems, but considers all special
30
31 requirements and is the common denominator of the relevant variants.
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36 In the "Generic Process View", abstract, generic process models are built.
37
38 They derive from the appropriate consolidation of the "Public View" process models
39
40 of the various collaborative parties, by combining the identified patterns of the
41
42 processes, without any country specifications and are modelled using the BPMN
43
44 notation. Those generic process models are designed at the highest abstraction level
45
46 possible, so as to be able to fit easily to different countries without interfering with the
47
48 internal private processes of the parties involved. Public activities of each role are
49
50 being linked through messages. Interactions are then visualized very easily and they
51
52 serve as the basis for more technical process description (e.g. automation using a
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54 Business Process Execution Language (BPEL) (OASIS 2002) engine in order to
55
56 orchestrate the transaction). The documents that are described in the transactions have
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3 to be based on generic re-usable components that are able to capture all the required
4 data needed for each transaction partner and the different rules that apply have to be
5 able to be executed at runtime and to be able to include all the underlying statutory
6 (Janner et al. 2008) and business framework.
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12 Advance and state of the art modeling notations and methodologies have been
13 selected for the process modeling phase in the different view levels of modeling.
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15 Namely, the Business Process Modeling Notation (OMG 2009) has been used thought
16 the modeling phase, in order to extract executable code from the final models using
17 the Business Process Execution Language.
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24 25 26 **5. Generic Business Process Models**

27 The various B2B, B2G and B2I transactions have been modelled using BPMN up to
28 the generic process view, following the methodology which was presented in the
29 previous section, by taking into consideration the differences that are present in each
30 country.
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35 As a demonstrator for this paper, one of the most frequent B2B transaction between
36 enterprises was selected, which is no other than the “Invoicing with credit note”
37 process. Figures 3a and 3b depict the generic process model which derives from the
38 proposed methodology, where all logical steps, the required documents and the
39 decision points of the transactions are included. Rules or time events are also present.
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41 In this example transaction, the supplier issues an invoice with a credit note and sends
42 it over to the customer, who after reviewing the invoice accepts or rejects the invoice
43 and the accompanying note in order to proceed with the payment.
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55 Especially for Greece, the supplier may issue a delivery note in case the
56 payment will not be performed right away time and the invoice can in this case be
57 issued after the payment, or he can issue a delivery invoice in case the payment is
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3 processed together with the delivery. This exception in the whole process, together
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5 with another one which is about requesting and providing clarifications between the
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7 two parties, is depicted in the generic model presented in Figures 3a, 3b as the part of
8
9 the transaction inside the boxes between the two pools. During the implementation,
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11 these steps can be left outside the workflow, as they are not of a great importance for
12
13 the transaction, as it can be carried out either way. In this case, the Greek enterprise
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15 needs to adjust to the generic model by performing some business process re-
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17 engineering to dismantle its processes and remove these additional steps. On the other
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19 hand, these exceptions can also be added into the generic process model and the
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21 adapters of other systems that are unable to process these information can just skip
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23 them, issuing blank documents. Table 1 presents the Model's Meta-Data.
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30 **6. Conclusions**

31 **6.1 Findings**

32 During a process modeling activity many issues may arise, which mainly involve the
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34 legal rules and the data entities that accompany each transaction in each country.
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36 Moreover, the way each transaction is carried out differs from country to country as
37
38 the business logic is not the same. Those issues are by de facto not taken into
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40 consideration when trying to design interoperable systems for conducting transaction
41
42 in country specific domains, as all enterprises operating in the same country follow
43
44 the same legal rules and have the same data requirements. When trying to extend the
45
46 environment of eBusiness by comprising cross-border and cross-sector transactions,
47
48 all the above issues rise to the surface and need to be tackled successfully. The
49
50 proposed methodology results in consolidated generic process model that do respect
51
52 all the underlying exceptions and aggregate all the underlying business logic, legal
53
54 rules and data requirements into a sole model for each transaction, satisfying the
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3 needs which spring out of the public processes. The abstraction level chosen defines
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5 the obligatory business document exchange which must take place, but at the same
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7 time does not interfere with the different internal processes of each party, as this are to
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9 a part addressed by the software adaptors that are responsible for the required system
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11 calls and data exchange and transformations. However, during the process modeling
12
13 steps, we have found that the diversity of the models lies mainly on the fact that
14
15 several rules regarding the legal issues or the data entities have to be applied, which
16
17 may or may not affect the internal of the parties' processes, depending of the
18
19 architecture that will be selected upon the system implementation process.
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24
25 Business to Business (B2B) transactions have almost similar business logic
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27 and follow the same business rules, with small differences. The way of conducting
28
29 business seems to follow a globally accepted process flow, which is present from the
30
31 smallest to the largest enterprises. However, the legal rules and the data entities that
32
33 accompany these transactions present a high degree of differentiation. This fact
34
35 springs from the national legislation and from the historical and social conditions
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37 which have shaped throughout the years the national business domain, based upon the
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39 domestic needs and requirements.
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44 Business to Government (B2G) transactions possesses a higher differentiation
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46 grade than B2B transaction in the terms of process flow and legal rules. However, as
47
48 far as it concerns the data entities included in those transactions, they slightly differ
49
50 from each other between different countries, as the low level information which is
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52 required by those transactions remains the same for each country (e.g. person details,
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54 address details, specific transaction details).
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58 Business to Institutions transactions seem to posses the smallest grade of
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60 differentiation not only in the process flow but also in the legal rules and in data

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3 requirements. This situation derives from the fact the inspected transactions included
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5 mainly banking operations, where almost every bank respects and follows an
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7 internationally agreed way of conducting business (Nikolaidou et al. 2001). This
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9 behaviour evolved from the need of forming a unified banking environment for
10
11 interconnecting the global markets. The results from these efforts produced common
12
13 agreed banking processes with the same data entities and with almost identical legal
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15 frameworks that were adopted by the different governments. Therefore, the Banking
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17 transactions can be easily modelled and implemented into interoperable business
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19 environments.
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25 Figure 4 describes the differentiation between the processes' categories
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27 regarding the data entities and the legal rules in a 3D diagram. B2I transactions have
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29 low differentiation in all three dimensions. B2G transactions have low to medium data
30
31 differentiation and high differentiation regarding the legal rules, whereas they have
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33 also medium to high differentiation Process Low differentiation. B2B transactions
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35 have medium to high data, legal rules and process flow differentiation which is why
36
37 the modeling and the harmonization of such processes is still a difficult operation.
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42 **6.2 Next Steps**

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44 The main objective of this paper was to present generic transaction models that are
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46 constructed by a methodological approach for enabling interoperability for processes
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48 in heterogeneous business domains by defining service flow orchestrations. Still, there
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50 are significant issues, such as legal rules integration, business documents standards
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52 for Business to Governmental and Banking Institutions transactions, which should be
53
54 challenged in the future for providing a fully interoperable environment. The work
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56 presented here will continue with the population of the proposed methodologies in the
57
58 modeling process of the as-is situation has pointed out various business process
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reengineering opportunities that can be applied in order not only to make the business process of various enterprises compatible with the generic model, but also to cut off those business models tasks that are seldom used and do not offer any real value to the enterprises. Therefore, a business process reengineering framework will be implemented which will act a supplementary tool of the complex methodology towards the harmonization of more business processes.

Another valuable extension is the development of a Standard Cost Model methodology which will be able to calculate the actual cost of a transaction and generate “what-if” scenarios based on the new proposed models in order to validate their advantages, which are all at the end calculated in terms of operating costs.

Last but not least, the implementation of a methodology for examining the compliance of a specific process variant to the standardized generic process model shall be foreseen and assess automatically (with the help of appropriate validators) the points of non-conformance.

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Table 1. Invoicing with credit note – Generic Model Meta-Data

Involved Parties	A. Customer B. Supplier	Main Workflow Pattern	B-A
Exchanged Documents	6	Decision Points (complexity)	7
Countries fit	6 (GR, TR, RO, BG, LT, CZ)	No. of Activities	23
Sub processes present (Decomposition)	none	Legal Framework Interference	High

Figure List

- Figure 1. Architectural Overview
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- Figure 3a. Invoicing with credit note– Generic Model (part 1)
- Figure 3b. Invoicing with credit note– Generic Model (part 2)
- Figure 4. Process Flow, Data and Legal rules differentiation between different transactions types

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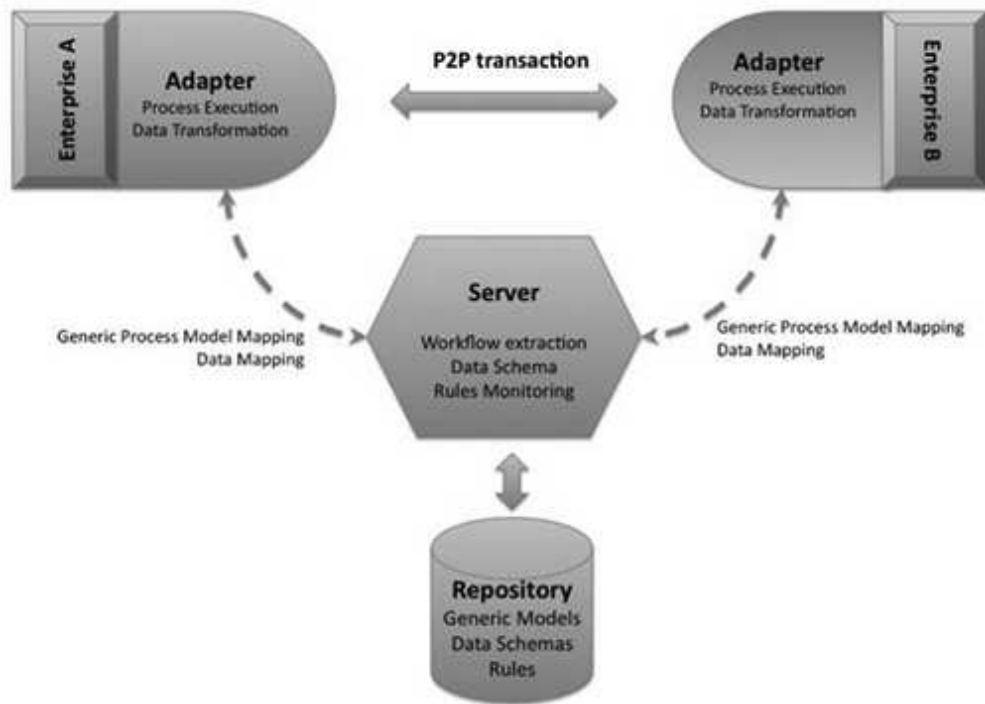


Figure 1. Architectural Over
178x128mm (72 x 72 DPI)

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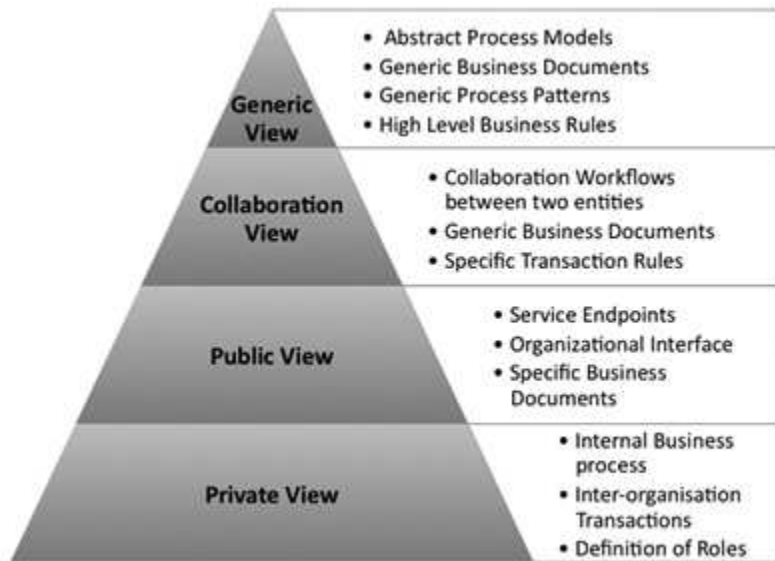


Figure 1. Architectural Over
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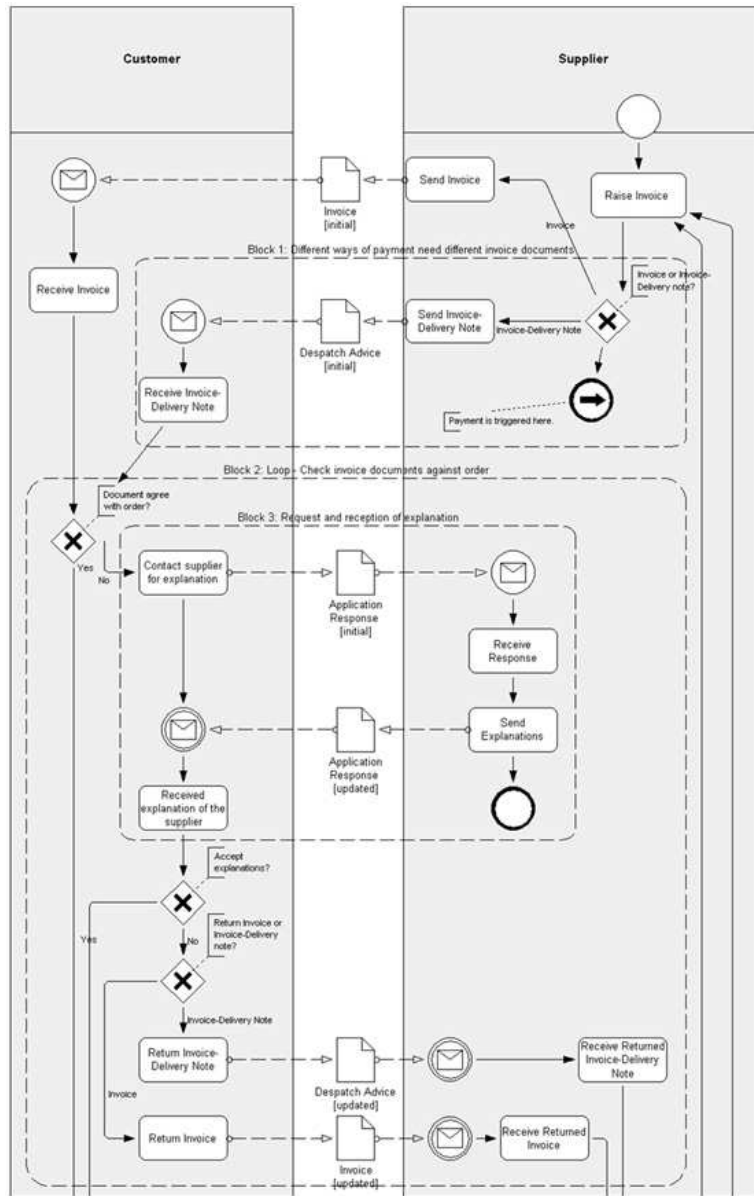


Figure 3a. Invoicing with credit note- Generic Model (part 1)
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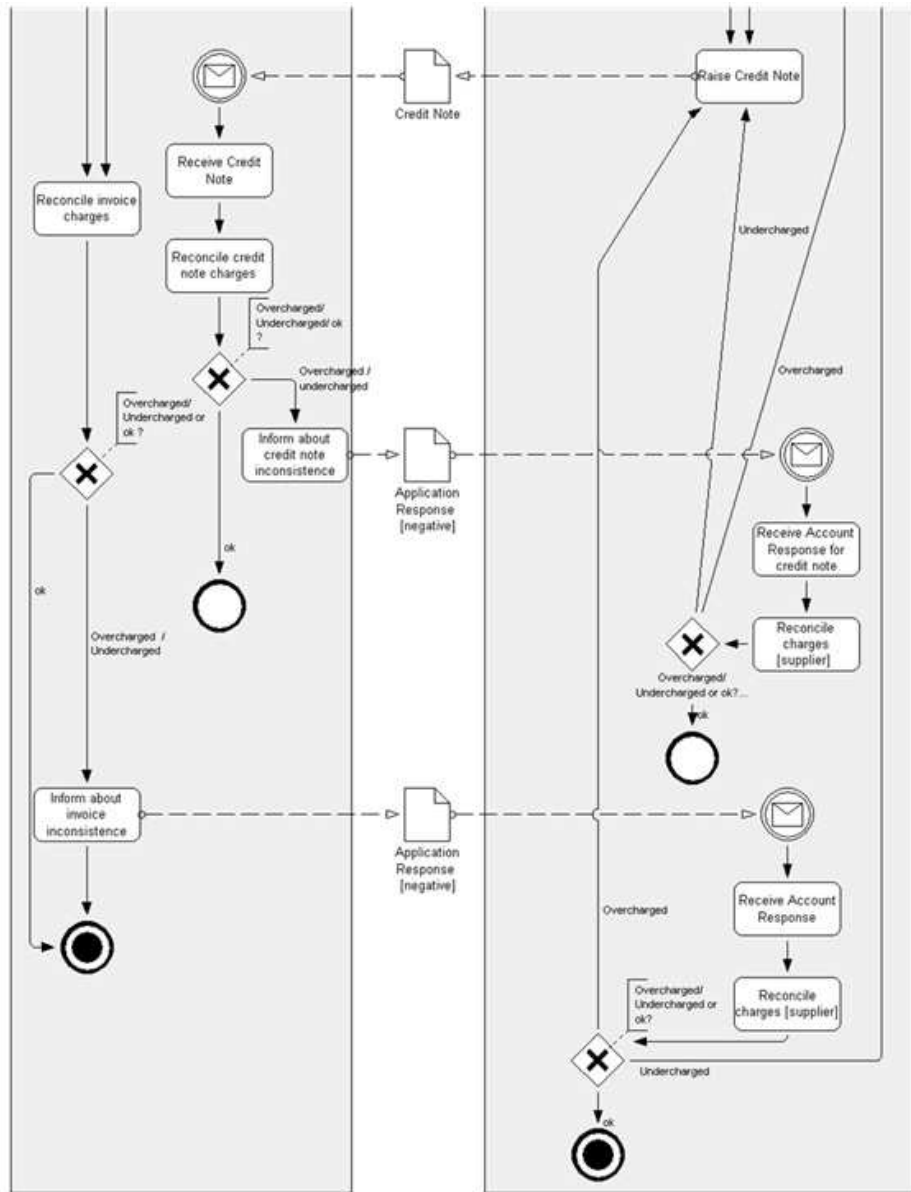


Figure 3b. Invoicing with credit note- Generic Model (part 2)
200x257mm (72 x 72 DPI)

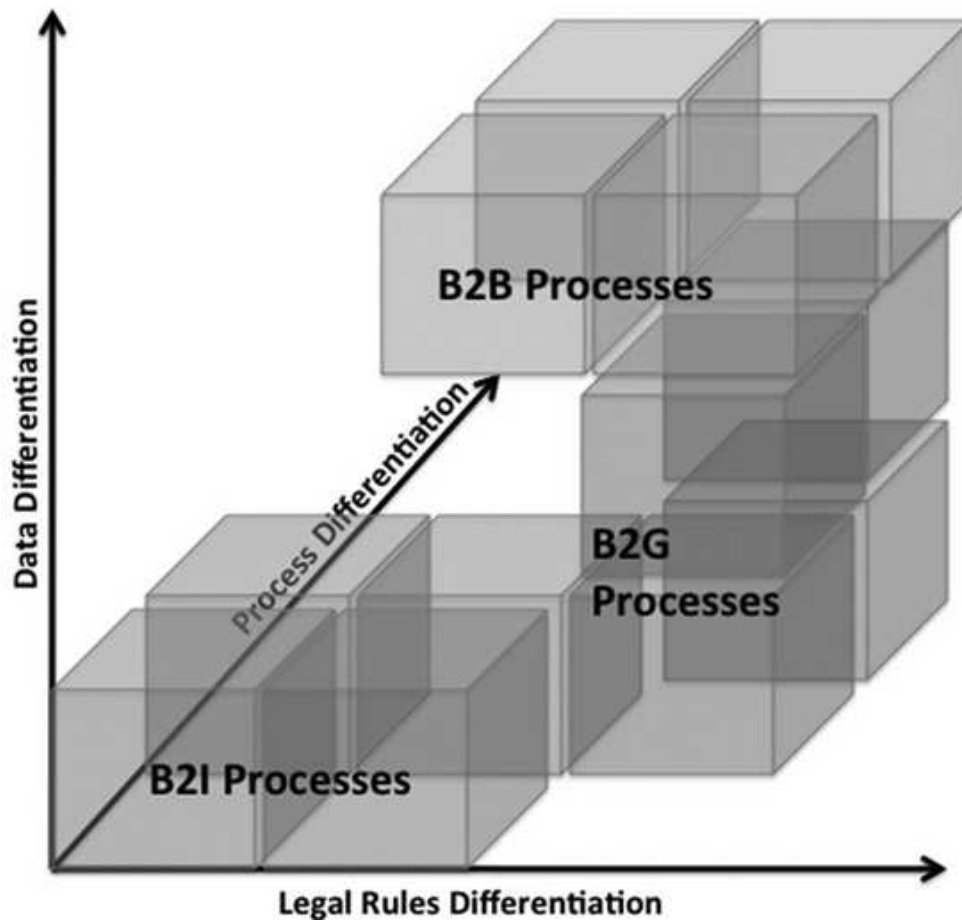


Figure 4. Process Flow, Data and Legal rules differentiation between different transactions types
197x180mm (72 x 72 DPI)