COMMON TEXTILE VOCABULARIES AND DOCUMENTS
A Conceptual Foundation of a Globally Interoperable Textile e-Marketplace

Jingzhi Guo and Zhuo Hu
Department of Computer and Information Science, University of Macau, Av. Padre Tomás, Pereira, S.J., Taipa, Macau
jzguo@umac.mo, ma66571@umac.mo

Keywords: Textile electronic marketplace, business vocabulary, business document, product data integration, vocabulary integration, document integration, semantic consistency maintenance, semantic interoperability, electronic commerce, electronic business.

Abstract: This paper has proposed a novel common textile vocabulary and document framework (TexVDF) in a collaborative network to enable cross-domain level business information sharing and business document exchange in a semantically consistent way. The approach to this framework is motivated through presenting some real-world examples of business inquiries with product specifications. By these examples, two problems are detected on how to achieve semantic commonality between cross-domain level business vocabularies for textile e-Marketplace mediators and how to allow specificity of cross-domain level common business document templates for local textile e-Marketplace mediators yet still maintaining semantic consistency. To solve these two problems, this paper has firstly reviewed CONEX technologies relevant to the newly developed TexVDF approach, which includes a TexVDF framework, a P2P collaborative textile concept mapping model and a textile business document template model. These two models have been demonstrated by examples to see how they should work.

1 INTRODUCTION

In global textile market, many textile firms face great challenges of increasing global competition to cope with quicker responsiveness of competitors (Teng et al. 2006), better global partnership, and advancing technology for manufacturing and dynamic consumer demand (Ostic 1997). To meet these challenges, textile industry needs to build global e-Marketplaces, where producer, supplier, and retailers can efficiently communicate and exchange information to strengthen their competitiveness. However, textile industry is complex. It involves raw materials such as cotton, silk and polymer that produce both natural and synthetic fibres, which again are converted into many kinds of fabrics and finally to become products such as carpet and apparel.

Besides, textile industry has thousands of large, medium and small sized retailers and manufactures (Teng et al. 2006). They vigorously trade with each other. This indicates that a global e-Marketplace in design must be able to manage the flow of millions of textile products between a very large number of firms. This requires the information exchanged by computers be understandable by all textile participants.

Making textile information understandable between participants on e-Marketplace is an important information interoperability issue (Guo 2007). It requires building a globally interoperable textile e-Marketplace by integrating heterogeneous textile information systems of all participated firms. This at least involves two aspects: the integration of business vocabulary used by all textile firms and the integration of exchanged business documents such as inquiries, offers, counteroffers and orders.

This paper aims to propose a novel common *textile vocabulary and document framework* (TexVDF) to semantically integrate complex textile firms to enable them to participate in textile e-Marketplace, and also to facilitate the proposed approach as the foundation of the future design of globally interoperable textile e-Marketplace.

The rest of the paper will be arranged as follows: Section 2 will provide a motivational scenario to raise our discussion issues. Section 3 will briefly introduce the relevant technologies and propose a new TexVDF approach to lay a solid conceptual foundation for future design of textile e-Marketplace. Section 4 will exemplify TexVDF approach. Related work is discussed in Section 5. Finally, the conclusion with a contribution list of this paper is given, together with the required future work.

2 A MOTIVATIONAL SCENARIO

e-Marketplace has four properties: distribution, autonomy, interdependence and emergence (Guo 2007). These also apply to textile e-Marketplaces. However, textile e-Marketplaces have a more specific property of *levelled-domain interdependence*, i.e. one level of textile e-Marketplace vocabularies and documents are tightly-coupled with another level of textile e-Marketplace vocabularies and documents. Since they belong to different domains, they have specific requirements, For example, they involve interdependence between levels of industries of raw supplies (e.g. cotton, silk and polymer), fibre, yarn, thread, fabric, printing and dyeing, and garment.

To motivate the problem to solve, Table 1 to 5 summarize the inquiries created by different levels of textile industries to show their interdependence.

Table 1: Raw Cotton Inquiry from Material Industry.

Concept	Concept Value
Product name	Indian raw cotton
Type	Shankar-6
Staple length	29 mm OR 28.5 mm
Strength	29 gpt or 28 GPT minimum
MIC	3.5-4.9

Table 2: Polyester Fibre Inquiry from Fibre Industry.

Concept	Concept Value
Name	Polyester Stable Fibre
Colour	Semi-dull raw white
Actual Denier	1.40 + / -0.05 (DE)
Dry Tenacity	6.50 + / -0.05 (G/D)
Dry Elongation	30. + / -1.5
Crimp number	13.00 + / -3.00 EA / Inch
Degree of Crimp	13.00 + / -0.39
Shrinkage	7 + / -0.07

Table 3: Blended Yarn Inquiry from Yarn Industry.

Concept		Concept Value
Name		Yarn
Colour		white
Type		Carded
Composition	Cotton	60%
	Polyester	40%
Count		32 s
Quality		high
Application		Quality knitting and weaving fabrics

An analysis to the above Tables reveals at least two of the following problems:

(1) Term usages are not only industry domain-specific. The higher-level industry has a high frequency to use the vocabularies of lower-level industry, but practically each level of industry has its own explanations on their terms in vocabularies.

This problem can be abstracted as a research issue of *cross-domain level business vocabulary commonality*, which states that all levels of textile industry shall be able to semantically communicate with each other via a common vocabulary model.

Table 4: Dyed Fabric Inquiry from Fabric Industry.

Concept		Concept Value
Name		Fabric
Type		Combed
Colour		Yarn dyed
Technique		woven
Style		Jacquard
Usage		Garment
Composition	Cotton	60%
	Polyester	40%
Construction		45 s × 45 s
Density		130 × 70
Width		57/58”

Table 5: Men’s Coat Inquiry from Garment Industry.

Concept	Concept Value
Name	Coat
Fabric	
Cotton	60%, ring, spun
Polyester	60%
Weight	300 grams/square meter
Specification	
Zipper	Front
Pocket	Pouch
Cuff	rib, lycra (cotton 60%, polyester 40%)
Bottom	rib, lycra (cotton 60%, polyester 40%)
Size	S, M, L, LL, LLL, LLLL
Drawcord	Fabric
Use	Men

This problem can be abstracted as a research issue of *cross-domain level business vocabulary commonality*, which states that all levels of textile industry shall be able to semantically communicate with each other via a common vocabulary model.

(2) Inquiry templates, as shown in Tables, from different levels of industry are different in syntactic forms and semantic use of terms, though they are all called as inquiry sheets. This phenomenon implies that a same type of business documents must be treated differently in specific domain-level industry.

We abstract this phenomenon as a research issue of *cross-domain level common business document specificity*, which states that all domain-levels of textile industry shall be able to personalize document templates from common document templates.

3 TEXVDF APPROACH

In this section, we will propose a novel common Textile Vocabulary and Document Framework (TexVDF) to solve the above two problems to lay a

solid foundation for future globally interoperable textile e-Marketplace. We vision that this e-Marketplace will be a common textile information space that all kinds of services and collaborative activities will be enabled, based on our designed TexVDF solution.

In the following, we will first discuss the relevant technologies and then propose the solution framework and its details.

3.1 Relevant Technologies

In CONEX research (Guo 2008), a generic e-Marketplace is designed like a multi-sons solar system as a set of common collaborative service mediators, each having a set of local collaborative service designers for their own service users on CONEX Network (ConexNet). It can be shown in Figure 1.

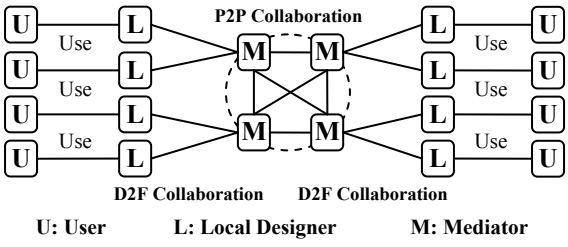

Figure 1: CONEX E-Marketplace.

In this CONEX e-Marketplace, business vocabularies and documents are firstly collaboratively designed at mediators (M) on a P2P collaborative network. Mediators include designer roles of common vocabulary design, dictionary design and document template design. These designers are knowledge experts (or knowledge engineers) and can make sure that things go right. Thus, they are called *dominators* (D) when their results are sold to local firms. The local firms subscribing or purchasing mediators' design services localizes these services into their own personalized forms, that is, local business vocabularies and document templates. The local designers are knowledge workers but are not experts. Thus, they are *followers* (F) of the dominators (D). The collaboration between dominators and followers is a dominator-to-follower (D2F) relationship on a point-to-point communication network. The follower cannot modify the common design but follow to generate their own. When local designers have designed local information about firm-based vocabulary and document templates, their users of their own firms can then automatically exchange business information, such as inquiries and offers.

In CONEX e-Marketplace, vocabularies and documents are designed following Product Map (PM) theory (Guo 2008). Its implementation is specified in CONEX Grammar (Guo 2008).

The information exchange by PM from one local firm (L) to another local firm (L) follows a concept supply chain (Guo 2008), such that:

Concept(L1) ***map onto*** **Concept(M1)** ***map onto*** **Concept(M2)** ***map onto*** **Concept(L2),**

where concept(L1) of L1 finally arrive at L2 as concept(L2).

Since concepts of L1, M1, M2 and L2 are all collaboratively created and mapped, there is no semantic inconsistency between them in theory. Thus, CONEX e-Marketplace provides an approach of accurate yet automatic information exchange in the perspectives of all users (U) of L.

3.2 TexVDF Framework

The TexVDF framework follows the design of CONEX e-Marketplace but adds the new *layer thought* to the framework. To provide a smooth discussion, we illustrate this framework in Figure 2, where different levels of textile industry have been separated but integrated in a coherent collaboration framework.

In Figure 2, CONEX e-Marketplace has been extended to include six layers of textile e-Marketplaces, which are:

- *Raw material e-Marketplace*, which focuses on trading cotton, silk, wool, fur, feather, plant, polyester, polypropylene, polyethylene, etc.
- *Fibre e-Marketplace*, which focuses on trading fibres made from cotton, silk, polymer (e.g. polyester, Dacron, nylon, Micron), plant (e.g. corn, soybean), etc.
- *Yarn and thread e-Marketplace*, which focuses on trading yarns of cotton, polyester, blended polyester, wool, plant, different threads, etc.
- *Fabric e-Marketplace*, which focuses on trading woven and non-woven fabrics of cotton, polyester, blended polyester, metallic, etc.
- *Printing and Dyeing e-Marketplace*, which focuses on trading dye, dyeing services of various yarns, threads, fabrics, printing, etc.
- *Garment e-Marketplace*, which focuses on finished textile products like jacket, pullover, shirt, protective garment, gown, gloves, etc.

By this layered classification of textile e-Marketplaces, a new technology of P2P collaborative mapping between e-Marketplace mediators is developed to solve the problems stated in Section 2. This technology complements the previous CONEX technology to enable cross-domain level vocabulary and document interoperability.

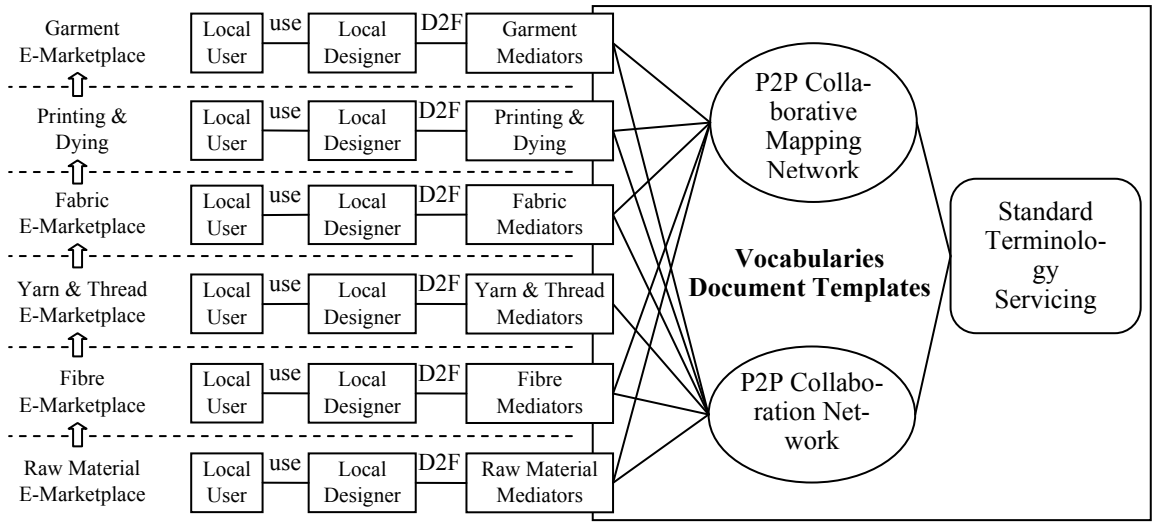

Figure 2: TexVDF Framework.

A standard terminology servicing centre is added to enable the adoption of existing standard terms such as standard measure, currency code, and *de facto* standard use of textile terms. This service will reduce the collaborative work effort occurred in both vocabulary and document templates for cross domain levelled textile e-Marketplaces.

Particularly, the TexVDF framework adopts a collaborative mapping solution to achieve semantic commonality of cross-domain level vocabularies and a specificity solution to using common textile document template.

In the next two subsections, we will elaborate the design of these two solutions.

3.3 P2P Collaborative Mapping

A *P2P collaborative mapping model* (CMM) is a solution to enabling various mediators of levelled textile e-Marketplaces to collaboratively work together to map their textile concepts in a common level but with possible expression variations for their own. This model is necessary because there are many synonyms and homonyms appeared in textile industry. Each textile mediator has its own concept mediation context and is not possible to define all synonyms and homonyms for each textile concept. The impossibility for each textile mediator to include all is due to the complexity that textile terms are developed from different contexts, where synonyms and homonyms come from various textile types, usages of dated and obsolete terms, term derivations, languages of origin, and toponyms (Leech 1999).

For example, "baby combing wool" has variation of "French combing wool"; "linen lawn" is synonymous with "handkerchief linen"; and "drab" is a homonym with meanings of "colour of a moderate to grayish or light grayish yellowish brown or light olive brown" and "cloth of a light dull brown or grayish brown or unbleached natural colour, especially a heavy woollen or cotton fabric".

To bind the concept expressions of individual mediators with a common concept expression, the mediators' concept expressions must be framed in a common structure, where they can freely express their ideas of categorizing their individual textile concepts. CCM provides this function in the following form, such that:

Definition 1 (CMM). *Collaborative Mapping Model*

Given a set of individual concept expressions σ_1, σ_2, ..., σ_n and uniquely identified by iid_1, iid_2, ..., iid_n under different mediators' contexts x_1, x_2, ..., x_n about a piece of common formal concept FC, defined by AN, uniquely identified by IID, typed by CT, inherited from IF, concept or context of CO, and possibly referenced to (RT) a standard term of a terminology, such that:

$$\Gamma \text{ |- } concept[IID, FC, AN, CT, IF, CO, RT] \Rightarrow map[concept[IID, iid_1, \sigma_1)@x_1], ..., concept[IID, iid_n, \sigma_n]@x_n],$$

where, "Γ" is a P2P collaborative mapping engine that enables all mediators to work together in real-time, "|-"is a declaration that all mapping follow the mapping structure that is defined, and "⇒" refers to that the semantics of each mediator's concept strictly follows the semantics of common concept for all.

The above CMM has following principles:

(1) Each mediator's semantics about the same concept must be semantically consistent by P2P collaboration following CMM structure.
(2) Personalized concept expressions of individual mediators, rather than the formal concept FC, are allowed to adapt to the local mediator's e-Marketplace environment but have to be mapped onto common concept via IID.
(3) Standard terms of terminology, from standard terminology servicing centre shown in Figure 1, are encouraged to be referenced during common concept design.

Particular to CMM, some details are important to mention.

Definitional annotation AN. It is a full definition of a common concept, and is not a single word or phrase that may not fully capture the meaning of the concept, or may lead to sense ambiguity.

Formal concept FC. It is a machine-readable term about a common concept. It may capture full or almost full meaning of the concept definition AN, but not guaranteed for accuracy. It is primarily used for information retrieval for search services. FC is typed as a set to include multiple words and phrases with exact or similar meanings to the defined concept such as abbreviation.

Internal unique concept identifier IID. It is unique identifier of AN with semantic causal order relationship such as AN $\Rightarrow$ IID. It implies that any IID cannot be created to use without the meaning of AN conveyed in IID. If such happens, it will be prohibited to process.

Reference to a concept RT. It is a reference to a semantically equivalent concept, often a well-defined term in terminology or an already-defined vocabulary by CMM. It is typed as a namespace use.

Context of a higher level concept CO. It defines the direct context of the current concept in a vocabulary hierarchy. For example, given "domestic appliances (domestic refrigerators)", the "domestic appliances" is the direct context of "domestic refrigerators". It is similar to a broad term (BT) in relation to a narrow term (NT) in controlled vocabulary (Fidel 1999). The CO is important for efficient and accurate information exchange. It is also very useful for accurate machine translation by *word sense disambiguation* (Vickrey et al. 2005) through CO context.

Inheritance from sources IF. It defines that where the concept is inherited or derived. It states the origin of the concept. It is useful for improving information retrieval and disambiguating the sense of the concept when the concept is applied in machine translation. For example, "ramie cotton blended fabric" is inherited from both "ramie" and "cotton" and under the context_of (CO) of neither "ramie fabric" nor "cotton fabric" but "blended fabric". The inherited terms of "ramie" and "cotton" are useful to infer the concept meaning.

Concept type CT. It defines in which term type the concept applies. For example, "bombazine" means "a twilled or corded dress-material, composed of silk and worsted; sometimes also of cotton and worsted, or of worsted alone". Thus, it belongs to the domains of "silk" and "cotton" as a noun-form, but it also belongs to the large domain of "textile" as an adjective form to refer to "worsted".

With above descriptions, the common concept *concept*[IID, FC, AN, CT, IF, CO, RT] is clear for individual mediators to collaboratively map onto their own local forms in map[concept[IID, iid_1, σ_1)@x_1], ..., concept[IID, iid_n, σ_n]@x_n]. In the local form, practically, the context x_i can be designed as an individual mediator's unique identifier (LID) to refer to its specific context.

3.4 Document Template Model

A *textile document template model* (Doclate) is a solution to enabling specifying business document templates to a domain-specific level but still being able to utilize the common document templates prepared in advance and to consistently use common concepts designed by CMM.

To realize this model, this paper regards a business document template a set of hierarchical concepts and improves the previous work of CODEX (Guo 2006) by removing P2P collaboration requirement and adding RT to CMM, such that:

Definition 2 (Doclate). *Document Template Model*

Given a set of concepts defined in CMM, there is a common document template (com) with a set of concepts (called elemon) hierarchically identified as IID, annotated by AN, in the context of CO, presented as DP, referenced to RT of CMM, and have occurrence OC; each "element" has a reification structure "value" to reify the concept with representation format PT, data type DT and possible function FN for managing reification. This "com" will further be extended to ($\Rightarrow$) "loc" to provide specificity of "com", such that:

Γ |- com: elemon[IID, AN, CO, DP, OC, RT](value[PT, DT, FN]) $\Rightarrow$ loc: elemon[IID, AN, CO, DP, OC, RT](value[PT, DT, FN]),

where "Γ" is a business document template editing engine, "|-" declares that the editing follows the structure defined.

The above model has the following principles:

(1) Each common document template "com" is only a semi-finished template and could be further

specified in any way to “loc”, but both must follow the Doclate structure model.

(2) Both “com” and “loc” can only create “elemon” concepts through RT to CMM vocabularies.

Particularly, the Doclate structure elements have the following semantics:

AN, IID, CO and RT. They exactly have the same interpretation as in CMM, but RT refer to CMM.

Document concept display phrase DP. It is a phase for visual display to represent concept. For example, a concept of “an appliance, a cabinet, or a room for storing food or other substances at a low temperature” could be visually displayed as “refrigerator” or “domestic refrigerators” as needed in the different designs of Doclate template.

Concept occurrence OC. It defines occurrence of concept in designed Doclate template. The concept occurrence may happen. For example, “product item” in a purchasing order may occur many times for different purchased items.

Value concept VALUE. This is a reification symbol to introduce a reification of a concept to a particular concept, for example, “colour” → “red”.

Presentation style of reified concept PT. It defines how a reified concept should be displayed. For example, “1” could be displayed as “1”, “one”, or “USD1/piece”. It is a logic module and implemented in a remote namespace.

Data *type of reified concept DT*. It defines the data type of the reified concept, for example, “string” or “decimal”.

Operational function of reified concept FN. It defines how the reified concept value could be computed, for example, automatically generated reified “date” value, reified computational group concept “total”, or a result of a logic module.

With the above descriptions, common document templates could be easily specified locally but accurately maintain semantic consistency between using parties of different levels of textile e-Marketplace.

Table 6: Textile Common Vocabulary for Garment.

```
concept[iid=“1.1” fc=“cotton” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“1.2” fc=“polyester” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“2” fc=“fabric” an=“-” ct=“n” if=“-” co=“-” rt=“-”]
concept[iid=“2.1” fc=“rib” an=“knit ribbing” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“3” fc=“weight” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4” fc=“coat” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4.1” fc=“zipper” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4.2” fc=“pocket” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4.3” fc=“hood” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4.3.1” fc=“drawcord” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4.4” fc=“cuff” an=“-” ct=“-” if=“-” co=“-” rt=“-”]
concept[iid=“4.5” fc=“bottom” an=“-” ct=“garment” if=“-” co=“-” rt=“-”]
concept[iid=“5” fc=“size” an=“-” ct=“-” if=“-” co=“-” rt=“msr:123456”]
concept[iid=“6” fc=“use for” an=“-” ct=“-” if=“-” co=“-” rt=“hba:12345”]
concept[iid=“7” fc=“specification” an=“-” ct=“-” if=“-” co=“-” rt=“spc:1”]
```

4 COAT EXAMPLE ON TEXVDF

In this section, we demonstrate TexVDF approach through a garment inquiry specified in Table 5. The following examples will adopt the written form of *vector concept tree* like “1.i...i” to represent the concept hierarchy of any vocabulary and document template (Guo 2008).

4.1 CMM for Coat Vocabularies

To implement the garment inquiry example, we first design the common vocabulary, shown in Table 6, based on CMM of definition 1.

With the above collaboratively designed garment vocabulary commonly for all levels of textile e-Marketplace mediators, individual mediators can localize their personalized vocabularies applicable to their own e-Marketplaces. Table 7 shows the localized mapping for one English mediator x1 and a Chinese mediator x2 for their own e-Marketplaces.

Table 7: Mapping of Local Vocabulary onto Common Vocabulary.

```
map[iid=“1.1”, (iid1=“aa” an=“cotton”)x1, (iid2=“111” an=“棉花”)x2]
map[iid=“1.2”, (iid1=“ab” an=“polyester”)x1, (iid2=“112” an=“聚酯”)x2]
map[iid=“2”, (iid1=“b” an=“fabric”)x1, (iid2=“22” an=“面料”)x2]
map[iid=“2.1”, (iid1=“ba” an=“ribbing”)x1, (iid2=“221” an=“针织布”)x2]
map[iid=“3”, (iid1=“c” an=“weight”)x1, (iid2=“33” an=“重量”)x2]
map[iid=“4”, (iid1=“d” an=“coat”)x1, (iid2=“44” an=“上衣”)x2]
map[iid=“4.1”, (iid1=“da” an=“zipper”)x1, (iid2=“441” an=“拉链”)x2]
map[iid=“4.2”, (iid1=“db” an=“pocket”)x1, (iid2=“442” an=“口袋”)x2]
map[iid=“4.3”, (iid1=“dc” an=“hood”)x1, (iid2=“443” an=“帽子”)x2]
map[iid=“4.3.1”, (iid1=“dca” an=“drawcord”)x1, (iid2=“4411” an=“拉绳”)x2]
map[iid=“4.4”, (iid1=“dd” an=“cuff”)x1, (iid2=“444” an=“袖口”)x2]
map[iid=“4.5”, (iid1=“de” an=“bottom”)x1, (iid2=“445” an=“下摆”)x2]
map[iid=“5”, (iid1=“e” an=“size”)x1, (iid2=“55” an=“尺寸”)x2]
map[iid=“6”, (iid1=“f” an=“used by”)x1, (iid2=“66” an=“适用”)x2]
map[iid=“7”, (iid1=“g” an=“cuff”)x1, (iid2=“77” an=“规格”)x2]
```

Given the above local mapping onto the common vocabulary shown in Table 6, the users of local textile e-Marketplace of x1 and x2 can then exchange business information without any semantic conflicts.

4.2 Doclate for Coat Inquiry

In this part, we exemplify the work of Doclate model in the example of Table 8 and Table 9.

Table 8: Common Document Template for Inquiry.

```
elemon[iid=“1” an=“” co=“” dp=“coat” oc=“” rt=“4”]
elemon[iid=“1.1” an=“-” co=“” dp=“fabric” oc=“” rt=“2”]
elemon[iid=“1.2” an=“” co=“” dp=“size” oc=“” rt=“5”]
elemon[iid=“1.3” an=“” co=“” dp=“use for” oc=“” rt=“6”]
elemon[iid=“1.4” an=“” co=“” dp=“specification” oc=“” rt=“7”]
```

In this simple document template, some content of the garment inquiry sheet has been designed. It then can be further defined by local e-Marketplace designers of document templates. The function of common level document templates is to reduce the time of local e-Marketplace document designers and thus to lower the e-Marketplace cost.

When local e-Marketplace designers obtain the rough document templates, they personalize them as their own needs, as shown in the example Table 9.

Table 9: A Particular Garment Inquiry Sheet Template.

elemon[iid="1" an="" co="" dp="" oc="coat" rt="4"]
elemon[iid="1.1" an="-" co="" dp="fabric" oc="" rt="2"]
elemon[iid="1.1.1" an="" co="" dp="weight" oc="" rt="3"]
elemon[iid="1.1.2" an="" co="" dp="cotton" oc="" rt="1.1"]
elemon[iid="1.1.3" an="" co="" dp="polyester" oc="" rt="1.2"]
elemon[iid="1.2" an="" co="" dp="size" oc="" rt="5"]
elemon[iid="1.3" an="" co="" dp="use for" oc="" rt="6"]
elemon[iid="1.4" an="" co="" dp="specification" oc="" rt="7"]
elemon[iid="1.4.1" an="" co="" dp="zipper" oc="" rt="4.1"]
elemon[iid="1.4.2" an="" co="" dp="pocket" oc="" rt="4.2"]
elemon[iid="1.4.3" an="" co="" dp="hood" oc="" rt="4.3"]
elemon[iid="1.4.3.1" an="" co="" dp="drawcord" oc="" rt="4.3.1"]
elemon[iid="1.4.4" an="" co="" dp="cuff" oc="" rt="4.4"]
elemon[iid="1.4.5" an="" co="" dp="bottom" oc="" rt="4.5"]
elemon[iid="1.4.1" an="" co="" dp="zipper" oc="" rt="4.1"]

In the above Table, a more specified garment inquiry sheet template has been designed. With this document template, users of local textile e-Marketplace can reify the template by filling the "value" information to automate inquiry exchange.

5 RELATED WORK

Textile e-Marketplace design that enables business information sharing and business document exchange is an important research field. In this design, semantic integration of textile vocabularies and documents are the foundation for a globally interoperable textile e-Marketplace. Currently, active researches can be found in DAMA and Moda-ML.

In U.S., TEXNET is a textile industry data-sharing network to address data sharing among business partners. It presents shared data in the screen or saved it in standard formats on a local platform (Lovejoy, a). Particular to the textile e-Marketplace, DAMA (Chapman et al. 2000) is a project of such type. DAMA applies a pipeline analysis method (Lovejoy, b). In DAMA's research, supply chain concept is adopted through Supply Chain Integration Program (SCIP), where an inter-enterprise decision support tool is developed to analyze supply chain tradeoffs. DAMA is designed to use TEXNET for data sharing. It intends to support information sharing and decision making between firms of retail, apparel, textile and fibre within a particular supply chain. While supply chain method for textile e-Marketplace integration is worth investigating, it has some entry limitations for small and medium sized enterprises to participate in.

In Europe, MODA-M (MODA-ML; Leech 1999) is a research on textile e-Marketplace. Its approach is based on the exchange of standardized XML documents, where ebXML protocol has been adopted to transfer XML messages. Moda-ML is ontology-based in design. It generates a modular ontology where each basic concept can be managed independently from the others and is identified by its own namespace (Gessa 2007). It has defined a common platform (Gessa et al. 2004), which attempts to be adopted by firms to improve their interoperability. Ontology-based ebXML document exchange is an attractive approach and fits in most research prototypes in many other e-Marketplaces. However, its success depends on the ontology interoperability by its own in semantic level.

It is necessary to make a clear distinction between the three general strategies of integrating heterogeneous business information (Guo 2008). They are mandatory standardization (a standard is enforced for all participants, in which heterogeneous information integration between standard systems and the participants' local systems is the task of the local participants), automated mediation (an intelligent agent as a mediator to mediate heterogeneous information between disparate participants' systems based on predefined rules, in which if no rules can be applied, mediation of heterogeneous concepts is not accurate), and collaborative conceptualization (heterogeneous business concepts between disparate local participants' systems must be collaboratively mapped on a higher level common system before they can be exchanged).

This paper adopts collaborative conceptualization strategy to avoid the weakness of mandatory compliance of standards by users and inaccurate concept mediation by intelligent mediator. Under this strategy, mediator is designed as a collaborative mediator to ensure the semantic consistency between heterogeneous concepts. This strategy absorbs some of the merits from both mandatory standardization and automated mediation strategies, but it creates no standards and mixes automated agents with human.

6 CONCLUSIONS

This paper has proposed a novel common textile vocabulary and document framework (TexVDF) in a collaborative network to enable cross-domain level

business information sharing and business document exchange in a semantically consistent way. The approach to this framework is motivated through presenting some real-world examples of business inquiries with product specifications. By these examples, two problems are detected on how to achieve semantic commonality between cross-domain level business vocabularies for textile e-Marketplace mediators and how to allow specificity of cross-domain level common business document templates for local textile e-Marketplace mediators yet still maintaining semantic consistency. To solve these two problems, this paper has firstly reviewed CONEX technologies. Then, TexVDF approach is presented in a TexVDF framework, which is an improvement of previous CONEX model. To realize TexVDF framework, a P2P collaborative concept mapping model and a textile business document template model have been developed. The former has resolved the problem of semantic commonality of local mediators' individual vocabularies, and the latter has solved the problem of designing common business document templates and their flexible specificity to document templates adaptable to local textile e-Marketplaces. These two solution models have been demonstrated in examples to see how they could work.

The TexVDF approach has been provided as a conceptual foundation for future design of globally interoperable textile e-Marketplaces. It has advantages compared existing solutions. (1) It does not enforce standards on business vocabulary and document templates. This implies a flexible solution to semantic consistency maintenance between participated textile e-Marketplaces. (2) The new framework it provides allows cross-domain level semantic interoperability but still enable personalization. (3) Useful terminology standards are welcome to be flexibly integrated into the new framework. It implies a standard integration but not rigid. (4) Vocabulary design between e-Marketplace mediators is collaborative in real-time. This enables semantic accuracy and avoids erroneous inference between individual e-Marketplaces for those taking the approach of independent vocabulary design. (5) Document template design and specificity adopt a simply hierarchical document structure where each document element concept referenced to a well-defined collaborative concept vocabularies in CMM. This enables simple creation and use of document templates.

Currently, the improved structure specification of TexCVF framework in terms of XPM is in final release stage. The future work of this paper will be the implementation of the textile e-Marketplace based on this conceptual foundation.

ACKNOWLEDGEMENTS

The work reported in this paper has been supported by University of Macau Research Grand.

REFERENCES

Censoni, P., De Sabbata, P., Cucchiara, G., Vitali, F., Mainetti, L. and T. Imolesi, 2002. MODA-ML: a Vertical Framework for the Textile-Clothing Sector based on XML and SOAP. In Challenges and Achievements in E-business and E-work. IOS Press.

Chapman, L. and M. Petersen, 2000. Demand Activated Manufacturing Architecture (DAMA) Model for Supply Chain Collaboration. In: International Conference on Modeling and Analysis of Semiconductor Manufacturing.

Fidel, R., 1999. Searchers' selection of search keys: II. Controlled vocabulary or free-text searching. Journal of the American Society for Information Science 42(7) 501-514.

Gessa, N., 2007. An ontology-based approach to define and manage B2B interoperability. Technical Report UBLCS-2007-11. Department of Computer Science, University of Bologna.

Gessa, N., Novelli, C., Busuoli, M. and F. Vitali, 2004. Use and extension of ebXML business profiles for Textile/Clothing firms. LNCS 3182. 186-195.

Guo, J., 2007. A Term in Search of the Infrastructure of Electronic Markets. IFIP Volume 255, Springer, Boston. 831-840.

Guo, J., 2008. Collaborative Concept Exchange. VDM Publishing, Germany.

Guo, J., 2006. Inter-Enterprise Business Document Exchange. In Proceedings of ICEC'06. ACM Press. 427-437.

Lovejoy, J.(a) Pipeline Analysis (PA):How Does your Business Flow? [online] http://www.techexchange.com/thelibrary/Dama/pa.html

Lovejoy, J. (b) Textile Industry Data-Sharing Network: A prototype for building bridges, using the Internet. [online]http://www.techexchange.com/thelibrary/Dama/texnet.html.

MODA-ML. http://www.moda-ml.org

Leech, P., 1999. Who Says Manchester Says Cotton. inTRAlinea 2 [online] www.intralinea.it.

Ostic, J., 1997. An Introduction to USITC Enterprise Analysis. [online] http://www.techexchange.com/thelibrary/Dama/An_Introduction.html.

Teng, G. and J. Hector, 2006. Integrating the US textile and apparel supply chain with small companies in South America. Supply Chain Management, 11(1) 44-55.

Vickrey, D., Biewald, L., Teyssier, M. and D. Koller, 2005. Word-Sense Disambiguation for Machine Translation. In HLT/EMNLP'05, Human Language Technology Conference and Conference on Empirical Methods in Natural Language Processing). The Association for Computational Linguistics. 771–778.