Conceptualizing the Ontological Framework for Service Dominant Logic for Islamic Banking and Finance

Amna Javed,
Japan Advanced Institute of Science and Technology (JAIST),
School of Knowledge Science, Japan.
E-mail: amna.javed@jaist.ac.jp

Roslina Othman,
International Islamic University Malaysia (IIUM),
Kulliyyah of Information and Communication Technology, Malaysia.
E-mail: roslina@iium.edu.my

Youji Kohda,
Japan Advanced Institute of Science and Technology (JAIST),
School of Knowledge Science, Japan.
E-mail: kohda@jaist.ac.jp

Abstract
The importance of Islamic banking and finance (IBF) has been widely accepted by not only Muslims but also non-Muslims, and many conventional banking have opened their Islamic banking window, partly because, the objective of Islamic Banking is to enjoin good and bring welfare to the people in addition to gain profit. The aim of our research is to explore the social value dimension and document extraction system of IBF.

Many empirical works about IBF have already carried out and been shared. The fundamental aim should now be at capturing the structured representation of the documents instead of only keyword retrieval related to the statements. This paper describes the ontological framework that conceptualizes the service dominant logic for IBF. Two main ontologies are proposed: the service dominant logic components ontology and the IBF ontology to mold the relationship between service science and financial service for the purpose of measuring the social values and impacts of IBF. We obtained these ontologies by following the mapping of research results from the banking sector in Malaysia.

The ontological framework has been designed as a framework leading to a model for resource integration enabling the mechanism of value co-creation in IBF from the view of social science, taking advantage of ontologies as the formal declaration and knowledge representation model. It provides a foundation upon which a machine understandable knowledge can be obtained. In this work, we present an ontology-based approach to enhance the effectiveness of a retrieval system with first, and the consideration for big data analytics in future.

Key Words: Service Dominant Logic (S-D logic), Islamic banking and finance (IBF), Resource integration, Ontology
1. Introduction

The recent trend from manufacturing economy to service economy has transited the goods oriented firms to the service firms. This paper is a great contribution for service science because service science is typically deals with the blending of research fields from computer science, social science and business management, but with the great focus on service dominant logic (S-D logic) (Maglio and Spohrer, 2008).

Service dominant logic is an alternative for innovation: and innovation is not explained only in terms of novelties, but it is also considered as innovation to create new markets through service provision. According to S-D logic, service is the basis of social and economic exchange rather than goods or products. There are some of the essential concepts of S-D logic that explain all the economies are service economies and all the businesses are considered as service systems. The components of the systems are four elementary components: values, service, resources and actors (Vargo and Akaka, 2009). This paper creates a linkage between all the four components of S-D logic by resource integration between the entities.

Resource integration has a dominant function that can be defined as service. Resource integration can be achieved by using the use cases of modelling. There are four use cases as: model to data linkage, model to model linkage, vocabulary extension and model to model transformation (Prackwieser et al; 2014). This paper explains all the contents by following the third use case (vocabulary extension). This case is considered to be the simplest one. And for the purpose of achieving vocabulary extension, this paper has introduced a semantic information in terms of ontology.

Ontology is a basis for the knowledge sharing. Ontologies mainly define the main concepts, sub-concepts including classes and the relationships between them. That finally provide a domain language that is important for both humans and machines (Kalaivani, Anandaraj and Raja, 2011). In general, ontology is categorized into two types: form-based (syntax) and content-based (semantic). This paper focuses on the latter (content based ontology). In the content based ontology, manual methods are usually applied on the given situation, such as application of an ontological model (Dang et al., 2008).

In this paper ontologies are being defined using the framework for S-D logic in Islamic banking and finance. The importance of Islamic banking and finance (IBF) has been widely accepted by not only Muslims but also non-Muslims, and many conventional banking have opened their Islamic banking window, partly because, the objective of Islamic Banking is to enjoin good and bring welfare to the people in addition to gain profit.
The aim of our research is to explore the social value dimension and vocabulary extension of IBF. The organization of this paper is as follows. Subsection 1.1 to 1.3 explain problem statement, research questions and research motivation. Section 2 covers the literature view of all the important keywords used in this research. Section 3 explains the methodology and provides an environment for building/using ontologies that is being developed by using the protégé software (version 5.0 beta 17) and discusses a framework of S-D logic in IBF. The method used in this research follows basically the concept of content mapping. Section 4 discusses the results and related discussion comparison. Lastly, Section 5 summarizes the achievements of this study and settles this paper with further concerns to be addressed.

1.1 Problem Statement

Over the past years, the growth in technology has made the increasing use of information retrieval as an emerging technique. That has pointed out the inadequacy of the currently existing techniques used for searching information available on the web that follow mainly the string matching approach (Doms and Schroeder, 2005).

The data or information retrieval system that are present nowadays are primarily grounded on full text correspondence of keywords or topics based taxonomy. The correspondence of keywords often yields a large number of inappropriate hits that do not fulfill the user’s query requirements. In order to solve this problem and to enhance the search using semantic environment, a technique named as ontology is implemented, specifically for the field of IBF using the terminology of S-D logic in this paper.

1.2 Research Objectives and Research Questions

The goal of this paper is to help IBF projects to get started with semantic web technology. Therefore this paper describes the classification of Islamic banking and service science among the domains involved in it using protégé software. By combining the concepts of ontology for IBF and S-D logic we can explain the importance of resource integration for the mechanism of value co-creation towards sharing service.

This research focuses on the following research questions:

i. Why do we need vocabulary extension in IBF?

ii. How resources are integrated by using ontology?

iii. What is the importance of resource integration for value co-creation in IBF?

1.3 Research Motivation

Many works have already been done on IBF but no work is done on the vocabulary extension and extraction system up till now.
By using ontologies as a starting point all the instances could be explained by interpreting just higher level discussions that follow one backbone story. This research explains the importance of resource integration that is considered as a key factor for developing a relation between value co-creation and resources, that must be companied altogether.

The goal of this paper is to help IBF to get started with semantic web technology with respect to S-D logic. This paper describes the ontological framework of S-D logic for IBF. This also defines the classes, properties and features of mapping contents to check semantic consistency.

2. Literature Review

By surveying literature this study highlights the importance of ontology for IBF and S-D logic. It also explains how frameworks and models can be used differently or jointly to explain the underlying concepts.

2.1 Ontology for Islamic Banking and Finance

Islamic banking and finance has grown at a remarkable pace for the last few decades. Since then, it has spread to most of the parts of the world and has penetrated into the conventional banking system with impressive results (Siddiqi, 2007).

This growth in IBF is continuously appealing more stakeholders but all are using their own concepts and definitions regarding IBF. There is no standardized way to resolve the ambiguity and misunderstandings related to the IBF major concepts. In the existing financial system all the terminologies mentioned are about conventional banking system (Newman, 2014).

Therefore this paper initiates vocabulary extension of IBF by using ontology that can promote standardization in future. In this paper, we aim to complement the service dominant logic ontologies by considering all the terms specifically used in IBF.

IBF is based on the Islamic principles known as Sharia law and offer sharia compliant products to the customers (IIBI, 2011). Islamic banking follows basic two principles, first, interest free products and services and second profit and loss sharing among the parties involved in the transactions (Javed, Kohda and Masuda, 2014). In addition Islamic law prohibits investment in the businesses that are unlawful (Ayub, 2007). Islamic banks have the same purpose of making money as conventional banks but under Islamic principles (Ahmad, Yousri, 2005).

2.2 Service Dominant Logic

With the increasing importance of services in the world a new paradigm is emerged known as service dominant logic (Vargo and Lusch, 2006). To better understand the term S-D logic, there are main principles and components that need to be understood first.
These components are explained as firstly, values that are evaluated by the customer or supplier involved in the business transactions and the creation of value in terms of goods is based on their value-in-use (Ballantyne and Varey, 2006). Values are always co-created by the parties involved like firms and the customers but firms are always responsible for value propositions. Value can be defined in two dimensions as economic dimension and non-economic dimension (Javed, Masuda and Kohda, 2014).

Secondly, service that is defined as an application of competencies for the benefit of third party, supported by knowledge and skills (Vargo and Lusch, 2004, 2008a). Service is generally categorized as direct or indirect service either in terms of goods or money (Kowalkowski and Ballantyne, 2009).

Thirdly resources that are defined as anything that is determined by an actor as a support to achieve future transactions and act in a way to integrate these resources basically for value creation and to improve the system viability. Resources can be tangible or intangible, it depends on the usage of resources (Vargo and Lusch, 2004).

Fourthly, actors that have some independent features that enable them to initiate service transactions, they are considered as entities with the ability of decision making and evolution, but they always act within the structure (Vargo and Lusch, 2008). Actors have resources and by utilizing the resources they can generate the services and finally they can utilize the values generated from the services as beneficiaries.

2.3 Frameworks and Models

Though models and frameworks can be defined separately to make clear the difference between them, they can support each other to organize the big pictures and proper communication. Both are used for visualizing the abstract structure, for communication and also for designing and utilizing the new concepts in a unique direction.

Models are basically concepts having their own assumptions. These can be stretched up to a predefined limit and are not able to differentiate between people. These are useful to explain the underlying factors of any problem (Schwanke, Smith and Edyburn, 2001). On the other hand, frameworks are the practical implementation of theories. It is defined as a system of rules and ideas that are used to plan or decide a supporting structure to build something new and unique (Lei Li and Horrocks, 2004).

This research will result in the development of frameworks and models for IBF in different perspectives to elaborate the success factors and points of differences of IBF from conventional banking system.
3. Methodology

A research methodology is defined as a technique that is basically a combination of method, process and a tool that support the research to be conducted in a research domain (Nunamaker et al. 1991). To conclude this research with significant results we have applied two kinds of research methods. The first method is conceptual. By using this method we have defined the concepts applied in the research with a set of comparative analysis of the existing literature to show the importance of our framework. Second, we have applied empirical method known as semantic. We have chosen the ontology technique that is popular nowadays.

The application of ontology with the help of Protégé software (version 5.0 beta 17) that provides an ontology constructing platform with a huge community of users. The software was applied on IBF as a case study in Malaysia where the Sharia compliant funds have surpassed over 50 percent of total market capitalization (Ramzan et al. 2012).

The data in Malaysia were collected from the websites of 5 Islamic banks in Malaysia. We have selected the major Islamic banking sectors in Malaysia with reference to their contribution in the market. The names of the banks are: Bank Islam, Bank Muamalat, CIMB Bank, Bank Am Islamic, and Maybank Islamic. By using the content mapping of research results from the banking sector in Malaysia we finally obtained the ontologies about S-D logic and IBF.

3.1 Ontology in Protégé

Ontology developed by using Protégé software can be explained as a network that is comprised of classes, individuals and their related properties. In the software classes normally classes define the names of the related concepts with domain and their unique features. Properties define the existing relationship between the concepts and the classes and assign a unique value to the instances. Finally the individuals are just instances of the classes (Song et al., 2005).

3.1.1 Classes

The most important task to build an ontology is to define the classes and subclasses of the concepts in the specific domain. In this paper many classes and related subclasses are created for IBF and S-D logic. Only one example of classes and subclasses of S-D logic are explained in detail in Fig. 1.

Figure 1 demonstrates the S-D logic in IBF as a subclass of service science in IBF and it is divided into further 4 sub classes named as: values, services, resources and actors. The class value has one subclass as co-created that is divided into further more subclasses as economic values and non-economic values. In parallel the class actors is subdivided into two subclasses of Islamic bank and customer or supplier or manufacturer as represented in Fig. 1.
In this paper a hierarchy of classes and subclasses in IBF is developed by using Protégé as shown in Fig. 2. Classes and subclasses are displayed on the left side of the display, and the properties and characteristics of the classes are displayed on the right side respectively.
3.1.2 Properties

Properties create relationships or linkages between classes. There are mainly two types of properties, object properties and datatype properties. Object properties define relations between individuals and link an individual to another individual. However, datatype property link the individual with data values. Both are comparatively different from one another. In this paper, to define the relationships between the classes three properties are mainly used (Table 1).

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Properties Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Has</td>
</tr>
<tr>
<td>2</td>
<td>Occurs between</td>
</tr>
<tr>
<td>3</td>
<td>Includes</td>
</tr>
</tbody>
</table>

Figure 3 demonstrates the view of object properties, and description of the properties by using Protégé.

Fig. 3: Object properties for classes and sub classes in Protégé software
3.2 Ontological Framework

This paper presents two views of ontology one is by using onto graph to display all the created classes and subclasses. This view also shows the relationship that subsists between each classes and subclasses. There are two main ontologies resides in this display one is ontology for S-D logic and the other one is ontology for IBF.

Section 2 explains that S-D logic is extended to four subclasses. First is actors that has 2 subclasses one is Islamic bank that has 3 further subclasses as: principles, impacts and segments, these subclasses are extended more. The other actors are customer and supplier or manufacturer with 2 subclasses as: bank accounts and contract. Table 2 demonstrates the whole details of classes and subclasses of actors.

<p>| Table 2: Division of Classes, Subclasses and Instances of Actors in S-D Logic |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|</p>
<table>
<thead>
<tr>
<th>S-D logic</th>
<th>Actors</th>
<th>Classes</th>
<th>Subclasses</th>
<th>Instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Islamic bank</td>
<td>Islamic bank</td>
<td>Principles</td>
<td>Contract based, Joint venture, Safety deposit, Fairness and equity, Sharia compliance, Sharia advisory, Consumer centric, Interest free</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Segments</td>
<td>Consumer</td>
<td>Deposits and Investments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corporate</td>
<td>Equity based</td>
<td>Murabahah, Mudarabah</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Financing of services</td>
<td>Asset based</td>
<td>Murabahah, Istisna, Salam</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impacts</td>
<td>Advantages</td>
<td>Ethical, High return, Liquidity, Less risky, Awareness for Islam, Transparency, Fast growth, Banking for all, Social justice, Less prone to inflation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disadvantages</td>
<td>Lack of regulatory documents, Lack of capital market, Lack of skilled human capital, Issues of contracts, Complex products, Less standardization, Less profitable, Restricted environment</td>
<td></td>
</tr>
<tr>
<td>Customer, supplier or manufacturer</td>
<td>Customer, supplier or manufacturer</td>
<td>Contract</td>
<td>Profit and loss, Value creation</td>
<td></td>
</tr>
<tr>
<td>Bank accounts</td>
<td>Bank accounts</td>
<td>Customer satisfaction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The second axiom of S-D logic is resource and we have classified the resources of Islamic banks in Malaysia on the basis of their context of usability. Sometimes resources can be used in terms of services provider and sometimes service itself. Resources are something that are used to
increase the viability of the system (Arnould, 2008). Table 3 explains the subclasses of resources in detail.

**Table 3: Division of Subclasses of Resources in S-D Logic**

<table>
<thead>
<tr>
<th>S-D logic</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strategic partnership, Online resources, Automatic teller machine, Mobile banking, Debit card, Credit card, Safe deposit box, Wealth management, E-debit, Cash deposit machines, Bank accounts, Financial resources, Sharia contracts, Project financing, Money market, Structured products, Fund management</td>
</tr>
</tbody>
</table>

The third axiom is service that can be defined as process, activity, benefit, or ability as well. In this paper service is explained as a benefit for the third party or actor itself (see Table 4).

**Table 4: Division of Subclasses of Services in S-D Logic**

<table>
<thead>
<tr>
<th>S-D logic</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smart alerts, Internet banking, Bills payment services, Wassiat/wills, Muamalat E-motor takaful, Remittances, Tabung Haji, Zakat, Online security, Schedule transactions, deposits, Investments, Withdraws, Term financing, Overdraft, Cash line, Accepted bills, Bills of exchange, Bills for collection, Car financing, Home financing, Letter of credit, Hire purchase, Leasing, Welfare (Online charity), E-shopping, Money transfer, Foreign exchange, Visa signature, Family takaful (Protection, Savings, Health, Education)</td>
</tr>
</tbody>
</table>

The fourth axiom of S-D logic is value. It can be defined as a growth in the well-being of an actor. Values can be co-created, can be introduced as value propositions (Normann and Ramirez, 1993). Values are divided into economic (monetary) and non-economic (non-monetary) dimensions (shown in Table 5).

**Table 5: Division of Subclasses of Values in S-D Logic**

<table>
<thead>
<tr>
<th>S-D logic</th>
<th>Values</th>
<th>Co-created</th>
<th>Non-economic values</th>
<th>Non-monetary values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Economic values</td>
<td>Monetary values</td>
<td>Profit, Service charges, Opportunity cost</td>
</tr>
<tr>
<td>Partnership</td>
<td>Cooperation</td>
<td>Effective communication (Customer driven excellence)</td>
<td>Sharing</td>
<td></td>
</tr>
<tr>
<td>Team work</td>
<td>Equality</td>
<td>Respect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freedom</td>
<td>Justice</td>
<td>Trust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honest (Fair dealings), Safe-keeping (Responsibility), Commitments (Accountability)</td>
<td>Uniformity</td>
<td>Visionary leadership, Accuracy, Decision making capacity, Purity and transparency</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4 displays the overall view of the ontology built for S-D logic and its implementation in IBF. The view is displayed by using onto graph in the software window.

![Onto Graf representation of ontological framework of S-D logic in IBF in Protégé software](image)

**Fig. 4: Onto Graf representation of ontological framework of S-D logic in IBF in Protégé software**

The other view is by OWL Viz that display an asserted model. Asserted model explains the view of different ontologies within a rich picture but in this paper only one view of S-D logic is presented because of limitation of the feature to copy the entire ontology. One of the ontologies is displayed in Fig. 5.
4. Results and Discussion

From section 2 and section 3 some of the results are concluded that are explained further.
4.1 Vocabulary Extension

In this paper by using contents mapping an ontology is built for S-D logic in IBF. It is a technique to expand the terms of a specific concept. Vocabulary extension in the form of ontology will help to build a standardized dictionary for the concepts of IBF to remove the ambiguity of terms used in IBF.

4.2 S-D Logic Model for IBF

In subsection 2.2, the 4 axioms of S-D logic are mentioned in detail as actors, values, services, and resources. The application of S-D logic in IBF can help to expand the field of service science with respect to Islamic culture. Figure 6 explains the whole demonstration of 4 axioms of S-D logic in IBF. The actors in IBF are customer, producer and Islamic bank itself. Actors utilize their potential resources and with the exchange of services between different actors, new resources are created. And as a result value is created by the co-creation of actors in the provided environment. All the actors in a system avail their potential resources with the exchange of services like: product or service delivery, goods and money to provide services to each other (shown in Fig. 6).

In IBF two contracts are created simultaneously one is between Islamic bank and customer, the other one is between Islamic bank and producer or supplier. Both contracts follow the same process towards value co-creation (Javed, Masuda and Kohda, 2014). Fig. 6 depicts the developed model of SD-logic for IBF that elaborates the role of Islamic banks and customers and Islamic banking and producer in the entire transaction towards value co-creation.

![Fig. 6: S-D Logic in IBF towards value co-creation](image)

4.2.1 S-D Logic Formula

A formula is developed as an illustration of the theoretical model of S-D logic in IBF (shown in Fig. 6). This formula explains the service system that is defined as a set of actors. This illustration tries to depict the whole mechanism towards value co-creation between different
actors. In Fig. 7 we have tried to describe the value co-creation between actors more formally, which can be applied to any two actors in a service system in general.

A service system := \{a \ (t \ (i)) \} : a set of actors, each possesses resources changed over time

A service-for-service exchange is occurred (potentially) between any two actors.

The event likelihood of a service-for-service exchange is highly dependent upon the resources that the actors, \(a_i \ (r_i \ (t))\) and \(a_j \ (r_j \ (t))\), have at the time \(t\), i.e., \(r_i \ (t)\) and \(r_j \ (t)\).

[For instance, when they know each other, the event likelihood will be high.]

New (operand and operant) resources, \(\Delta r_i \ (t)\) and \(\Delta r_j \ (t)\), are co-produced

and given to actor \(a_i \ (r_i \ (t))\) and \(a_j \ (r_j \ (t))\), respectively, as a result of resource integration between the two actors,

\[\Delta r_i \ (t) = RIF(a_i \ (r_i \ (t)), \ a_j \ (r_j \ (t)))\]

and \(\Delta r_j \ (t) = RIF(a_j \ (r_j \ (t)), \ a_i \ (r_i \ (t)))\)

which results in a renewal of the status of the actors as

\[a_i \ (r_i \ (t+1))\] where \(r_i \ (t+1) = r_i \ (t) + \Delta r_i \ (t)\)

and

\[a_j \ (r_j \ (t+1))\] where \(r_j \ (t+1) = r_j \ (t) + \Delta r_j \ (t)\).

[RIF is a resource integration function, process, procedure, etc.]

A service-for-service exchange is a pair of service, \(s_q\) and \(s_p\), where

\(s_q\) is an offering from \(a_i \ (r_i \ (t))\) to \(a_j \ (r_j \ (t))\), which produces \(\Delta r_i \ (t)\) and

\(s_p\) is an offering from \(a_j \ (r_j \ (t))\) to \(a_i \ (r_i \ (t))\), which produces \(\Delta r_j \ (t)\).

A service could be a form of a product,

economic currency (money as service rights in future),
social currency (social capital through the obligation for future service),
or public currency (redistribution of money, e.g., tax).

New values, \(v_i \ (t)\) and \(v_j \ (t)\), are co-created

and given to actors to \(a_i \ (r_i \ (t))\) and \(a_j \ (r_j \ (t))\), respectively, as the result of the service-for-service exchange, \(s_q\) and \(s_p\), where

\[v_i \ (t) = VF(a_i \ (r_i \ (t+1)))\]

and

\[v_j \ (t) = VF(a_j \ (r_j \ (t+1)))\].

[VF is a value generating function, process, procedure, etc.]

Fig. 7: An Illustration of S-D Logic Formula

4.3 Resource Integration in IBF

This research concludes the resource integration in IBF that explains the importance of resources in value co-creation.

Many researches are already conducted about value co-creation but there is no research done to show the significance of integration of different resources. The actors act as resource integrators and with the integration of resources they create new resources as shown in Fig. 8. The hierarchy of Islamic bank and customer or supplier is already explained in Table 2.
5. Conclusion and Future Work

This paper describes a framework of an ontology construction for S-D logic in its implementation in IBF to extract information about the field. With the construction of framework of ontology of S-D logic and IBF, the researchers and other banks who indulged in the sector will attain the context-based knowledge and information of service science and IBF based on the developed vocabulary in the form of ontology.

It provides a foundation upon which a machine understandable knowledge can be obtained. In this work, we present an ontology-based approach to remove the ambiguity of the terms in IBF but in future this work will be extended to enhance the effectiveness of a retrieval system with the consideration for big data analytics. It will help to develop a decision making system based on knowledge reuse using semantic web technology.

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