Information and Knowledge Architecture Needs for Managing a New Global Reserve Currency

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The global financial system now appears to be heading for a new crisis, triggered in large part by growing and unsustainable levels of global debt. Reserve currencies are an essential element of the world financial infrastructure, and are widely recognized for their role in facilitating international transactions. History has taught us that these reserve currencies are transient over time, being subject to adjustments and changes as economic conditions evolve. The United States dollar now serves as the de facto world's reserve currency. However, this is unlikely to continue, unchanged and unchallenged, into the future. The G20 and the International Monetary Fund (IMF) appear to be considering a new reserve currency, like the Special Drawing Rights (SDR), that involves participation of many currencies, including the Chinese Yuan. The question is not only what will become of this new global reserve currency, but how this currency will be managed and by whom. One of the critical issues associated with this new global reserve currency is that of determining the information and knowledge systems architectures that will be required for managing the new global currency, including whether a Service Oriented Architecture (SOA) would be helpful in and suitable for managing the new global currency. An extremely important element in this determination is the need for a strong governance protocol that all the sovereigns will accept and comply with. Otherwise a new global reserve currency with a major information and knowledge based architecture foundation will likely be unsustainable. The purpose of this paper is to develop a methodological foundation for the information and knowledge architectures that will be required for systems management of this new global reserve currency.

Field of Research: Global Financial Crisis, Global Reserve Currency

1. Introduction

The global financial system appears to be heading for a major financial crisis. This crisis is being driven by a growing global debt. This crisis is not limited to nations such as Greece, Spain, Portugal, Ireland and Italy that have not been major performers in the global financial system but to such others as the United States that have been major players. While there has been a great deal of emphasis on sovereign debt in the past, to this must now be added private debti. The emphasis has often been on the reduction of this debt, either sovereign or privateii, by the debtor; however, the issue also involves the creditors when the amount of debt is substantial. When the debt is sufficiently large, a default will quite adversely impact the creditor. The increase in debts or soft assetsiii is a problem caused by either a significant increase in available credit to debtors, or by the availability of low value currency. The increase in debts results in a vicious negative feedback cycle for all debtors and especially for those sovereigns whose currency is a

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major global reserve currency, due to the global demands for increased liquidity (Reisen 2010).

In many cases, the underlying causes of the impending financial crisis are much more complex that those just identified. As this paper will show, it is the complexity of these causes and their interrelationships, coupled with a lack of a global financial management system, which may be the real culprit in the impending and growing global financial crisis. The underlying causes of this crisis are as follows: currency markets; reserve currency issues; sovereign financial policies; speculative commodity markets; lack of global financial governance; and lack of global financial management systems.

One important facet of the potential crises brought about by these issues is the world reserve currency and how it is managed. The concept of reserve currencies is widely recognized and often used for international transactions. A reserve currency is generally used as the international pricing currency for products that are traded on a global market: such as oil, grain, gold, etc. There is a very long history of the concept of a reserve currency (Rickards 2011, Stiglitz 2011). The major influences on global reserve currencies are a combination of economic and political powers, or perceived political powers.

Currently, the US dollar is the major global reserve currency; however, this is also a transient condition. If the world is to truly maintain a stable reserve currency, it is imperative that a system connecting the various global currency systems be identified, implemented, and managed. We have a system of systems to consider in enabling this. To achieve a desired change in reserve currency, markets will generally be the first movers, followed by subsequent reactions by governments. This is similar to events which occurred at the Bretton Woods Conference which reached currency agreements in July 1944 by establishing the dollar as the reserve currency. However, establishing this reserve currency in 1944 did not establish any agreement concerning how the global reserve currency would be managed. What in fact was created was a ***currency system without currency systems management.***

2. Literature Review

There have been a number of studies in the past dealing with the issue of global reserve currency. These studies have varied from presentations on the nature of global reserve currency (Moneyenergy 2009) to possible alternatives (Reisen 2010, Stiglitz 2011, Cardullo and Lui 2012, Rickards 2011).A number of studies have focused on the global financial markets and associated issues including reserve currencies (Strupczewski 2011, Subacchi and Jenkins 2011).

While some general studies on governing the global financial system have been published (Williams, 2008) little if any has been published on the actual management of a global reserve currency except (Cardullo and Sage 2011) which is a discussion of an approach of which this paper is a continuation and expansion.

3. Methodology for Global Reserve Currency

The important definition of a reserve currency is that it is a currency which is held in significant quantities by many governments and financial institutions as part of their foreign exchange reserves. Fluctuations in the value of the currency used as foreign

exchange reserves may well change the global financial landscape significantly. It is important to note that there is no essential or necessary world reserve currency; it could be any currency – even one that does not exist yet.

The world reserve currency also acts as the international pricing currency for oil, gold, and other products that are traded on world markets. Many countries argue that this serves to artificially inflate the value of the US dollar insofar as this potential value increase becomes the major reason countries need to and desire to hold the dollar (Moneyenergy 2009).

Economists debate whether or not a single reserve currency will always dominate the global economy. It has been argued that, since there are strong incentives for a nation to conform to the choices that dominates the marketplace, one currency will almost always dominate the marketplace, primarily because of network externalities. The United States reliance on exchange rate depreciation results in the Federal Reserve issuing a currency and increasing the amount of currency in circulation in order to help correct its current account deficit. These actions are increasingly being viewed by other nations as incompatible with the current role of the United States as the issuer of the international reserve currency (Subacchi and Jenkins 2011). The Group of 20 nations, known as the G20, is preparing a roadmap for evolving the global reserve currency away from that of the United States dollar (Strupczewski 2011). The G20 seem to be moving towards a basket of currencies in order to produce stability in providing global liquidity.

As a currency of a nation or region becomes less stable, or as the economy of that nation or region becomes less dominant over time, the international financial markets will attempt to abandon use of the then existing currency in that nation or region for a currency that has been issued by a larger nation or region with a more stable economy. This happening is not assured however. It can take a relatively long time, as appropriate recognition of the need for this change is important in determining a new reserve currency. The United States appears now to be moving in this direction, such as through increasing sovereign debt and encouraging currency devaluation by increasing the money supply. This may lead to the appearance of a currency which can over time become less stable. In fact, this is a negative feedback cycle where greater availability of the currency of a nation or region leads to less stability for this currency rather than more.

Another situation of importance is the buildup of such soft assets as debt. As has been shown, the buildup of soft assets in a nation or region may well eventually result in a collapse of the financial markets in that nation or region (Cardullo and Lui 2011). This potential crisis, especially when this is coupled with the growth of both sovereign and private debts, illustrates well the need for appropriate global financial regulatory structures in nations and in regions.

An important element in developing a stable global financial system is an accepted global reserve currency that all nations will adhere[iv] to. Today no such system, or system of systems, exists. The associated problem can be defined and illustrated by first looking at the need components, four of which are:

- Need for a schedule for G20 leaders to achieve more cooperative solutions to international financial challenges;

- Need for a framework for global financial cooperation;
- Need to change the zero-sum[v] mentality that is often the source of prior failures in global financial cooperation; and
- Need for a global financial management system with governance rules that all participatory nations agree to follow.

This problem, and the need components that lead to the problem, is deeply associated with individual sovereign policies which are currently based on use of a zero-sum game mentality and reliance on this mentality in order to determine outcomes. It appears that few sovereign governments are willing to foster the needed cooperation until a major global financial collapse occurs. Then the resulting financial catastrophe may take generations to resolve. However, as history has shown with the Bretton Woods Agreement and other agreements which have been developed, none of these agreements have been based on appropriate information or knowledge management systems or information and knowledge architectures that are capable of being used in managing system implementation.

Recent years have witnessed a tremendous growth in information and knowledge technologies that facilitate the design and implementation of complex systems management processes. These technologies, especially when coupled with robust information and knowledge architectures, can serve to assist in developing a stable global financial framework. One of the major innovations here been based on the concept of a Service Oriented Architecture (SOA) [Andary and Sage, 2010]. A SOA may form the basis for linking the global financial markets. This can provide each of the participating enterprises including sovereigns with capabilities for maintaining their existing systems through using a SOA.

To achieve an informational and knowledge system for management of a global reserve currency a methodology elucidating the various steps in the process is critical. These steps should include

1. Development of mission statement: This step should set forth an analytical framework for development of a detailed mission statement and IDEF0 activity diagram for a proposed architecture.
2. Development of a data model: This process step can provide a means of determining the data for the various services that can be included in the architectural framework, such as: Forex Information Services, Global Reserve Currency Services, Sovereign Notification Services, Forex Intervention Services, Notification Services, Analytical Services, Management Services, and based on the data analysis develop a system dictionary and concordance.
3. Development of a rule model: It is important to develop a rule model for the stable operation of the proposed architecture. This should include include the development of decision variables, Condition matrix, decision tables and proposed governance and management structures.
4. Development of a dynamics model: A dynamics model with state transition diagrams is an important element in the methodology. This executable model can provide an evaluation of the ability of various architectures to handle 4, 5 or 20 currencies.
5. Development of a physical architecture: This is the need to develop a physical architecture to combine with the resulting functional architecture. This will require

the formation of planning teams from the various participants and their agreements.

6. Development of a governance structure: Without an agreed upon governance structure no architectural framework can be implemented. On the participating stakeholders, who many are sovereigns, will need to develop and agree upon a governance structure.

Currently, there is no system of systems for management of global reserve currencies. The values of these currencies are based on market conditions and are thus open to speculation by traders. This suggests that a totally new systems architecture must be developed once the various sovereign states agree to have such a system. So there are a number of steps that must be taken prior to systems engineering of an architectural framework and an associated model for an appropriate system of systems.

The initial phase in the process for management of a new global reserve currency is to achieve agreement on the structure of a new global reserve currency between the members of the G20. This is the most important basic phase prior to the development of an architectural framework for a system of systems architecture. Assuming that this basic step has occurred and that agreement has been reached, either by the G20 or by an equivalent group, then the next phase in the process is the identification and development of the mission to be accomplished and associated processes, such as shown in Figure 1.

Figure 1: Mission Decomposition Chart
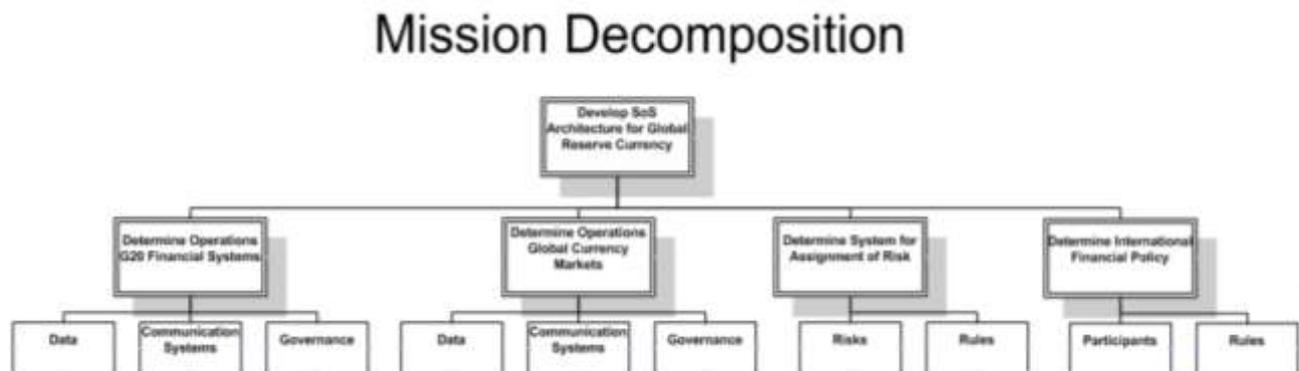
In this development of the mission to be accomplished and the associated process, there is a concern that the global monetary system has systematic problems which arise due to use of certain reserve currencies. For long periods in the economic history of the world, this reserve currency has been the metal gold. Starting in 1945, with the Bretton Woods agreement, the US dollar and its conversion to gold became the global reserve currency. However this development rapidly failed, and now the US dollar reserves represent approximately 60% of the reserve currency of the world. Other reserve currencies include the Japanese yen, the British pound, and the European Union euro.

The Triffin dilemma resulted in the observation that when a national currency also serves as an international reserve currency (as the US dollar does today), there are fundamental conflicts of interest between short-term domestic and long-term international economic objectives. One approach to help in stabilizing the global financial markets is to choose a basket of currencies that is sufficiently large to possibly eliminate the problems caused by the Triffin dilemma. The suggested approach here is

to use a basket of currencies based on the G20 with others being added as deemed appropriate.

3.1 Tasks

Initially, choosing a basket of currencies based on the G20 results in a number of tasks that need to be performed in order to include the associated concerns in development of the architectural framework. The G20 is made up of the finance ministers and central bank governors of 19 countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, Republic of Korea, Turkey, United Kingdom, and the United States of America. Each of these sovereign nations has various financial information and knowledge management systems and associated data formats. This complexity hampers developing an information and knowledge base for systems management and will require developing a unified data dictionary and obtaining concordance of the systems.

The following represents an assumed group of tasks needed in the development of the architecture for the system of systems being discussed here.

3.1.1 Determine Operations Global Currency Markets

An important element is the operations of the global currency markets. The global currency markets are known as the foreign exchange market (Forex, FX, or currency market) which is a worldwide decentralized over-the-counter financial market for the trading of currencies. Financial centers around the world function as anchors of trading between a wide range of different types of buyers and sellers around the clock. The foreign exchange market determines the relative values of different currencies. Accomplishing this task for the global currency markets will require understanding the operations of the markets data flows that are developed as part of this determination.

3.1.2 Determine a Management System for the Assignment of Risk

The assignment of risk is basically the providence of the credit rating agencies. A Nationally Recognized Statistical Rating Organization (NRSRO) is a credit rating agency (CRA) which issues credit ratings that the U.S. Securities and Exchange Commission (SEC) permits other financial firms to use for certain regulatory purposes. There are ten organizations which have been designated as NRSROs(Wikipedia 2011): Moody's Investor Service; Standard & Poor's; Fitch Ratings; M. Best Company; Dominion Bond Rating Service, Ltd; Japan Credit Rating Agency, Ltd; R&I, Inc.; Egan-Jones Rating Company; LACE Financial; and Realpoint LLC.

The credit ratings that are issued on sovereign securities have a definite impact on the currency value of a nation or group of nations. It is important to determine how these credit rating agencies assign risk and the potential impact that this has on currency value.

3.1.3 Determine International Financial Policy

The international financial institutions are responsible for associated financial policy. An international financial institution (IFI) refers to one or more financial institutions that have been established by more than one country, and hence are the subjects of international

law. Their owners or shareholders are generally national governments, although other international institutions and other organizations may occasionally serve as shareholders. The policies established by these agencies will impact global financial transactions. These agencies are also a source of data appropriate for use in helping to manage a new global reserve currency.

3.2 Summary of Strategy

To develop an appropriate system of systems model of the architecture for a new global reserve currency, either structured analysis or object oriented approaches can be utilized. In either case an appropriate initial approach would be to use the five stage process described in (Wagenhals and Levis 2000) and obtain a complete decomposition of the mission for the SoS used in management of a new global reserve currency. The decomposition presented in this paper illustrates the difficulties that will have to be overcome in development of this model of the architecture for a new global reserve currency. Section 4.0 presents a system of systems model based on a Service Oriented Architecture (SOA) and the associated services needed. The standards that must be considered in developing a SOA for a new global reserve currency financial system and associated SOA including the financial and architectural are presented in Section 5.0. Section 6 presents a summary of potential for management of new global reserve currency.

3.3 Service Oriented Architecture

A service-oriented (SOA) approach is intended to utilize services to promote the shared use of common capabilities across the global financial system. As such, the services need to be, among other things, (1) self-contained, meaning that they do not depend on any other functions or applications to execute a discrete unit of work; (2) described in detail and which can be openly accessed; and (3) use well-defined and standardized interfaces. An SOA can potentially provide a significant advantage in aligning the various global financial functions, including capabilities. One of the basic concepts of SOA is that it is an approach to defining integration architectures based on the concept of services. This helps to integrate different applications to exchange messages with one another, even if the applications are incompatible and run in different operating environments. This is achieved through the use of an enterprise service bus.

There are several assumptions that need to be realized if an SOA is to be implemented for the management of a new global reserve currency. Four are especially important here.

- All participants have agreed to have a management system.
- All participants will link their sovereign financial information systems into the new system.
- All participants will upgrade their financial information systems to an agreed operational level.
- All participants will abide by the governance structure.

To properly use the SOA approach for the development of this new monetary systems management, it is very important, as a necessary condition, to define the services that this requires, and the linkages necessary to form a new global financial system. The proposed global monetary system has no prior precedent and a functional services

oriented architecture can only be achieved through coordination and cooperation of all the participants. The current global financial system, while fairly mature, is also very fragmented as illustrated by the major recession which the global system has been in since 2008. The focus initially should be to bring together the leaders of the sovereign global financial systems and then to obtain consensus on the structural formation of this new global reserve currency system. This will likely require the formation of many coordinating teams from the different participants in order to deal with the associated problems. Initially it will be important to develop a proposed scope and strategy for framing and determining an architectural framework for this monumental project.

3.4 Services

Services are reusable modular units of capabilities, processes, or technical functions that can be accessed and delivered repeatedly (Marks and Michael 2006). The notion of a SOA has been employed in the financial arena, but only for individual financial institutions and their services.(Rabhi et al. 2006) We are not aware of any reference to the use of SOA for the information and systems management of a global financial structure. While some major global banks use SOA (Rabhi et al. 2006), it appears limited in its use.

Since global reserve systems management architecture requires agreement among sovereign states, the initial system that is developed may not contain an optimal set of services. However, the initial systems architecture must have sufficient flexibility to accommodate future services and expansions of existing services as these occur over time. These future services should evolve around the information needed to determine and manage a new global reserve currency and to ensure that it is maintained within a certain reference range. The data, information, and knowledge that would be required for this would necessarily have to arise from the currency markets. This is known as the foreign exchange market (Forex, FX, or currency market) and is a worldwide decentralized over-the-counter financial market for the trading of currencies. In this market, financial centers around the world function as anchors of trading between a wide range of different types of buyers and sellers. The foreign exchange market determines the relative values of the different currencies.

An appropriate set of policies would have to be chosen such that the manager of the global reserve currency would have the ability, either directly by the managers or indirectly by individual sovereigns, to intervene in the currency markets within a set range of values. If the managers of the global reserve currency did not have the ability to intervene in these markets, the value of the reserve currency would become volatile and susceptible to manipulations. Currently, sovereigns do intervene in the currency markets to maintain stability for their particular currency. In a new reserve currency management system, the manager, in this case the IMF should directly intervene in the currency markets or should advise certain of the sovereigns that they would have to intervene. A possible systems architecture for this, which is illustrated in Figure 2, distinguishes the following types of services:

3.4.1 Forex Services

This consists of a transaction-based system that acquires data, information, and knowledge from the Forex exchanges dealing with the currencies contained in the
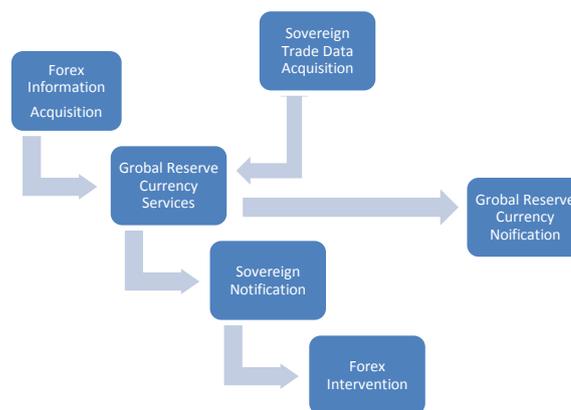
basket used to determine reserve currency value. This data, information, and knowledge will need to be obtained on a real-time basis.

3.4.2 Sovereign Trade Services

These services manage data, information, and knowledge related to the sovereign trade happenings that are used to determine value of the reserve currency based upon specifications set by the G20 and the IMF. The data, information, and knowledge could be historical or could be obtained in real-time from the appropriate corresponding systems of the sovereigns.

Figure 2: Global Reserve Currency Architec

3.4.3 Global Reserve Currency Services

These services manage data, information, and knowledge about reserve currency situations (e.g. accounting data, announcements, etc.) over time. This data, information, and knowledge could be historical or it could be obtained on a real-time basis. These services would allow the participants, managers and other authorized uses to obtain various needed data, information, and knowledge and would also serve to manage the approved policies.

3.4.4 Sovereign Notification Services

These services manage the notification of sovereigns and their central banks about suggested or required interventions in the Forex markets in order to maintain a global reserve currency within agreed upon ranges.

3.4.5 Forex Intervention Services

These services monitor intervention actions by either the sovereigns or their central banks in order to determine adequacy of their intervention actions as based on recommendations of the sovereign notification system. This provides valuable historical and real-time data, information, and knowledge for governance considerations.

3.4.6 Notification Services

These services issue notifications to participants, international bodies, financial markets, and the public on the status and the value of the global reserve currency. The notifications can be real-time for certain of the participants or delayed depending upon the policies that have been approved.

The following two potential services can be included although they are not initially basic:

3.4.7 Analytics Services

These include data mining and visualization applications which analyze real-time or historical data. These comprise a variety of models for different purposes, such as offering valuable insights on trends for analysts, determining trading opportunities for checking compliance for regulators and for pre-emptive action on the part of the management of the system (Rabhi et al. 2006).

3.4.8 Management Services

These services can vary widely in the quantity and quality of the services they provide for participants. Common features involve formulating strategy based on some objectives, providing information, implementing plans, managing participant requests and providing appropriate distribution of internal and external studies.

3.5 Stakeholders

There are a myriad of stakeholders who can potentially have interest in the development of this important information management system. These major stakeholders include: Sovereign governments; Central banks; IMF; G20 organization; Forex market; Bank for International Settlements (BIS); International Organization of Securities Commissions (IOSCO); International Financial Reporting Standards (IFRS); Financial Stability Forum (FSF); and Rating Agencies. Each of these major stakeholders has individual stakeholders that, in many cases, are sovereign states with differing political and economic objectives. Their nested sets of objectives must generally be corrected in order to develop a workable and appropriate architectural framework.

3.5.1 Sovereign Governments

These are the central stakeholders for the global reserve currency. These governments are concerned with the stability of their economies and currencies. Therefore, these "stakeholders" will need to collectively approve any system of systems for managing the global reserve currency. They will also need to agree to abide by the rules of governance for the management of this system of systems. In the past, a number of sovereigns have utilized a 'zero-sum game' to manage their currencies and thus 'beggar their neighbor'. In this way, they achieved their objectives independent of the results on the total financial system. Such actions must be precluded if a new global reserve currency is to serve appropriately to stabilize global financial transactions. Untill these actions are precluded it will be very difficult to have a stable system since non-complying entities will forcefully 'game' the process.

3.5.2 Central Banks

This is the monetary authority which usually issues the currency, regulates the money supply, and controls the interest rates in a nation. It possesses a monopoly on printing the national currency, which usually serves as the nation's legal tender, and in intervening in financial affairs when this is necessary. The primary function of a central bank is to provide the nation's money supply, and also to control interest rates and act as a lender of last resort to the banking sector during times of financial crisis. The role for central banks in influencing macroeconomic outcomes has also changed as a result of the inter-connectedness of capital markets and the internationalization of financial flows. In recent years, there has been a shift from a direct and administered system to market determined and marked based systems for determining interest rates, exchange rates and other key financial variables (Williams 2008).

3.5.3 International Monetary Fund (IMF)

The IMF has the important role of providing lender of last resort services and facilities to many nations, both developing and developed. In addition to providing lender of last resort facilities and services, it also provides an important economic and financial monitoring function through its Article IV consultations and Financial Sector Adjustment Programs (FSAPs). The IMF has been upgraded by the G20 to become the main forum for international financial and economic affairs. Actions to initiate reforms to the international monetary system may signal that the IMF may become the key institution to deal with functioning of the global foreign reserve currency system. There are a number of associated problems which must be overcome to insure success. A major one is that is the existing IMF governance must change in order to match the different political and economic landscapes and the deep mistrust of the IMF that has built up over the years among developing countries, especially after the IMF response to the Asian financial crisis in 1997–98 (Subacchi and Driffill 2010).

3.5.4 G20 Organization

The G20 are a grouping of twenty sovereign nations that has a secretariat structure[vi]. The G20 was established in 1999, in the wake of the 1997 Asian Financial Crisis, to bring together major advanced and emerging economies in order to stabilize the global financial market.

3.5.5 Forex Market

The foreign exchange market (Forex) is a global, worldwide decentralized over-the-counter financial market created for the purpose of trading currencies. The foreign exchange market determines the relative values of different currencies based on supply and demand. It supports speculation, and facilitates the carry trade[vii], in which investors may borrow low-yielding currencies and lend or invest in high-yielding currencies, and which may lead to loss of competitiveness in some countries.

The foreign exchange market is unique because of several factors. It has an extremely large trading volume, leading to high liquidity. It has considerable geographical dispersion and continuous operation over time. It covers a variety of factors that affect exchange rates. It is easy to trade in because of low margins of relative profit compared with other markets of fixed income. It makes use of leverage to enhance profit margins

with respect to account size. This foreign exchange market is a dispersed market, whose participants have many 'tentacles' and as such can quickly adapt to various reserve currency actions. It will take serious analysis of how this can be harnessed in order to provide a stable global reserve currency.

3.5.6 Bank for International Settlements (BIS)

This is an international organization which fosters international monetary and financial cooperation and which also serves as a bank for central banks. The BIS is a forum formed to promote discussion and policy analysis among central banks and also within the international financial community. It serves as an international center for economic and monetary research. It acts as a prime counterparty for central banks in their financial transactions and as a trustee in connection with international financial operations.

3.5.7 International Organization of Securities Commissions (IOSC)

This is an international organization of regulators of the securities industry whose objective is to cooperate with one another in order to promote high standards of regulation, to exchange information, and to provide mutual assistance and protect the integrity of the securities markets.

3.5.8 International Financial Reporting Standards (IFRS) Organization

This is an international organization which issues standards adopted by the International Accounting Standards Board (IASB).

3.5.9 Financial Stability Forum (FSF)

This organization was established in 1999 to promote international financial stability. It does not include developing countries among its members. It makes recommendations and calls for their implementation to establish financial centers in both emerging markets and in developing countries. The FSF is part of the BIS and, if it widened its mandate to include continual monitoring rather than deal with issue based approaches, it would become the kind of entity which has the track record needed to coordinate regulatory and oversight functions of bank regulation, securities, insurance accounting rules and payment system issues, and monetary and financial stability issues, and possibly global reserve currency issues (Williams 2008).

3.5.10 Rating Agencies

The international rating agencies have a very important role to play in determining operations affecting the global reserve currency. It is these agencies and their ratings that can 'trigger' currency speculation. Therefore, a close integration of the system of systems to be engineered with the informational systems of these agencies is critical.

3.6 Governance

Governance is a process or a set of processes which can help ensure that the laws, policies, standards, and procedures of the governed body are being adhered to. Governance establishes chains of responsibilities, authority, and communication to empower decision rights (Brown et al. 2009). Governance also establishes measurement, policy, and control mechanisms to enable decision makers to implement these processes. There is a definite difference between management and governance. In SOA, governance is the successful implementation of the processes required for the implementation and maintenance of the policies which have been set for the reserve currency architecture. The governance is about the way order is brought about in a system to accomplish a specific purpose.

There are a number of deficiencies which have impaired the ability of international institutions to take adequate actions in order to prevent, and/or to respond to, a global financial crisis. There is generally a need for major reforms in governance of international institutions, including giving a greater voice and greater transparency to developing countries (Brockmann 2009). One of the basic problems in the global financial community is that only a limited set of data is generally available in a timely manner and in a manner that facilitates international cooperation, with the exception of data concerning market prices and regulatory information,. Another basic problem is that there is no single international oversight body in the financial world (Williams 2008).

It is important to develop concepts of financial stability in order to assure that a new global reserves currency involves various financial intermediaries, financial market segments and infrastructure, for which different quantitative and qualitative indicators can be used to forecast and measure the financial situation. Determining the degree of financial stability remains a highly integrated complex task. This requires that the governance system, which has responsibility for ensuring financial stability, must be able to monitor information and knowledge, and to analyze developments, in several financial sectors in order to determine measures of financial stability (Subacchi and Jenkins 2011).

An important issue relative to the key concern regarding enforcement of any adjustment of imbalances is to determine who should bear the burden of adjustment when domestic policy choices are inconsistent. It has been emphasized that the reserve currency countries ought to have a greater responsibility for meeting the rules given the impact they have on the system (G20 2009). Figure 3 presents a possible SOA governance paradigm describing this.

Figure 3: SOA Governance Paradigm (Based on data contained in (Brown et al. 2009)$)$
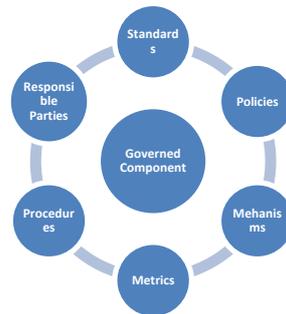
The basic principles for an appropriate governance model are manifested by creating organizational structures that follow defined, practiced and perfected processes and which use resources and tools to perpetuate their own existence. These form the operational aspects of the governance model. The principles affecting the behavioral aspects of subjects being governed, in this case the various stakeholders involved in the global reserve currency system, have a bearing on the interplay between the branches of operational governance (Bohra et al. 2005). SOA governance must govern the entire service cycle from strategy to design to development to operations and management.

3.7 Standards

There are two classes of standards that must be considered in developing a SOA for a new global reserve currency financial system and associated SOA.

3.7.1 Financial Standards

The formulation of internationally acceptable standards represents a significant effort to reform global financial architectures and in making a new global currency system stable. The international financial community has started to enhance transparency and to design international financial standards which are based on the Bretton Woods institutions; IMF, BIS and others. Importantly, these are also based on the efforts of national governments regulatory agencies to cooperate with their overseas equivalents in order to design more effective regulatory standards and to fulfil their respective legal mandates. These mandates have often not been productive and have often proven themselves problematic. This is another area for support.

Many of the financial international institutions, such as the IMF, World Bank, and global banks; have dissimilar activities, varying degrees of international exposure, and divergent preferences for the design of standards for sound managerial practices and data systems. Private interests such as Forex, which is involved in global currency markets, dominate public purposes. Financial standards therefore may reflect the preferences of powerful market players, such as major traders and financial institutions, and skewing the outcomes of a new global reserve currency system which could provide them with greater returns. These standards should promote market stability and public interests. However, the greater participation of private sector agents in the standard setting process may skew objectives and may make it more difficult for the sovereigns and their institutions to maintain objectives for a new system. It is very

important to establish a set of comprehensive standards representing best global practices toward which all countries participating in the global system would strive and a governance system to insure that these standards are adhered to.

There have been a considerable number of efforts to establish international standards and codes of good practice that build on and offer the potential to globalize the standards that exist within the most advanced nations (Subacchi and Jenkins 2011). The IMF has been a forum for formulating standards or codes of good practice for governments in its core domain of responsibilities, which are already well advanced and now being implemented. It is assumed that the IMF will develop the standards for a SOA for the new global reserve currency management system. Many other agencies have been working to develop standards in their areas of expertise: accounting, auditing, corporate governance, payment and settlement systems, insurance, data and bankruptcy. The Financial Stability Forum (FSF) was established to encourage a dialogue among the many relevant national and international agencies and has contributed to harmonizing global standards for regulation and supervision.

The Special Data Dissemination Standard (SDDS) has been adopted by the member countries of the IMF, the large majority of which participate actively in capital markets. The IMF together with the BIS, a representative group of central banks, the World Bank, and the OECD among others, has issued a Code of Good Practices on Transparency in Monetary and Financial Policies. A major concern and question relative to these standards and policies is the difficult challenge of implementation. Implementation of harmonized financial standards requires that international policy makers make sufficient allowance for national political economies and provide enough time to make necessary adjustments. Market participants need to be familiar with the standards recognized by the FSF as key to sound financial systems or the IMF-World Bank Reports on Observance of Standards and Codes (ROSCs) (Vojta and Uzan 2001).

Regulation and supervision of international financial markets and in particular a new system for managing a global reserve currency is likely to be very demanding as: information asymmetries, i.e. not all participants are fully aware of all information, cannot be fully removed; accounting standards have shortcomings and are open to interpretation; legal authority is accompanied by operational constraints; and the public support needed to insure appropriate regulation and supervision may not always be available. Self-interest and self-preservation ('zero sum games'), combined with the temptations of power, influence, and money, may distort the incentives of many politicians and government officials to work for the public good and an associated stable global reserve currency system (Chami et al. 2009).

The information requirements for new global reserve currency management will necessitate cooperation from all essentially all of the stakeholders. The associated information standards must be robust and be able to evolve as the global reserve currency system will inevitably evolve. Sovereigns, their central banks, tax havens and financial institutions in both developed and developing countries that fail to meet basic standards of transparency, information exchange, and regulation should be given strong structural incentives to reform their practices. However, sovereigns by their nature will often resist any movement which appears to reduce their sovereignty.

The global financial crisis of 2007-2009 has made it apparent that there are large gaps and deficiencies in the regulatory structures in place in many countries and. It is

apparent that an effective regulatory system must be international and there must be some global regulatory framework to establish minimum national standards and also govern the global operations of systemically relevant global financial institutions and their information systems (Brockmann 2009).

3.7.2 SOA Standards

An SOA is based upon an information environment that is built upon loosely coupled, reusable, standards-based services (Andary and Sage 2010). The integration and interoperability requirements and standards implemented are derived primarily from industry best practices and existing standards. There is a difference between interoperability and integration. Even when following prescribed accepted standards, there may be and generally will be interoperability gaps. A well-structured data management system must be part of the digital information infrastructure of any SOA implementation. The SOA for the management of a new global reserve currency needs to consist of a grouping of standards: semantic; technical; and portability.

3.8 Summary of Potential for Management of New Grobal Reserve Currency

An Enterprise Architecture (EA) framework is the logical structure for classifying and organizing such complex information as a new global reserve currency. Frameworks help organize integrated models of systems such as to determine what will be required to manage a global reserve currency. Currently, there is no system of systems for management of any global reserve currency. The values of the currencies are currently based on market conditions and are thus open to speculation by traders concerning potential individual sovereign government interventions. This means that a new systems architecture must be developed once the various sovereign states agree to have such a system. So there are a number of steps that must be taken prior to even formulating an architecture model for an engineered system of systems.

There are growing concerns that the global monetary system has systematic problems, and that these problems are financial and due to the asymmetric nature of information available to manage the myriad of sovereign currencies. The scale and nature of various financial crises has raised fundamental questions about the current models of financial markets and their management.

Once the G20, IMF and the BIS have chosen an approach to what will become a new global reserve currency the question will arise on how it is to be managed. Using SOA approach, functions and applications are defined and designed as discrete and reusable capabilities or services that may be under the control of different organizational entities.

A version of SOA, similar to Federal Service Oriented Architecture (FSOA) (Council 2008) which is based on a shared, standards-based infrastructure could be useful in supporting implementation of a new global reserve currency management system if appropriate agreements to engineer this SOA have been concluded among the sovereign participants.

There are a myriad of stakeholders who can potentially have strong interests in development of this important information and knowledge management system. Each of these has now and in the past used policies that appear to be of self-interest even though the web of global financial interactions links each with the other. Therefore this

complex system can easily be driven unstable by the actions on one or more participants. The various participants will therefore need to modify their self-interest, in the interest of global financial stability. It is imperative that that the system to be developed and implemented can manage and resolve complex issues in the reserve currency arena.

The structure of services will revolve around the information needed to set the reserve currency and to ensure that it was maintained within a certain reference range. The associated decisions may well serve as another continuous point of disagreement across nations.

Systems management of a global reserve currency should result in the ability to intervene in the currency markets, or to inform the sovereigns or their central banks of possible inventions, so that the value of the reserve currency does not become volatile and susceptible to manipulation. Currently sovereigns do intervene in the currency markets in order to maintain stability of their particular currency.

SOA governance must encompass the successful implementation of the processes required for the implementation and maintenance of the policies which have been set for the reserve currency systems architecture. This governance concerns the way order is brought about in a system to accomplish a specific purpose and the associated question of stability in the global financial system is one of the principle issues involved in a new global reserve currency.

It has been shown that the international financial community is in support of reform of the governance, accountability, and transparency brought about by the Bretton Woods Institutions and other non-representative institutions that are involved in the global financial system, such as the Bank for International Settlements, its various Committees, and the Financial Stability Forum. However, there is little understanding of or agreement on what type of reform the various sovereigns will accept. There is a need for major reforms in the governance of these international institutions, including giving greater voice to developing countries and greater transparency to the numerous issues that are present. This issue of governance of the total system of systems must be resolved prior to full implementation of any management system for a global reserve currency.

Determination of the information and knowledge management requirements for a new global reserve currency will require cooperation on the part of all the stakeholders. This can also become a contentious issue, since many of the stakeholders are sovereigns who may resist because they believe this would impact their sovereignty. The information standards must be robust and must be able to evolve as the new SOA will enviably evolve. The integration and interoperability requirements and standards can ideally be derived primarily from best practices and existing standards. The SOA Framework will most likely include the use of an enterprise service bus (ESB). Any service can be adapted into the ESB and will enable the various sovereigns to participate in one or more of the approaches to system of systems integration. This can be adapted to many of the systems which the GRC-SOA must be able to interface with if it is to truly serve as the master system for a new global reserve currency management system.

The standards for the management of an SOA for a global reserve currency will require dedication to achieving a robust system which can survive the vicissitudes of a global geo-political landscape with many potential pitfalls and become truly a 'system of systems' for the international financial community. The adoption of a robust GRC-SOA with a governance process adhered by all sovereign participants could lead to a stable global financial structure less able to be 'gamed' by potential adversaries.

4. Conclusions

This paper has examined information and knowledge architectures for managing a new global reserve currency to help maintain global financial stability. The management system for this new reserve currency cannot be developed without understanding the framework, services, standards and governance of the concerned nations for its successful operation. While many of the items discussed are speculative at this time, nevertheless the international financial community is striving to move to a reserve currency that can be managed effectively and efficiently and which offers a good degree of stability. Without such a revision in the global reserve currency and its robust systems management, the financial crises which the world has experienced over the last three decades will not only reoccur but their severity will continually increase. It is imperative that the major sovereigns and their financial institutions agree upon a roadmap to develop a global reserve currency that can provide enhanced global financial stability. An important element in obtaining this stability is information and knowledge based architectural framework which results in currency management that is robust, capable of evolving and adaptable through an accepted and enforceable governance structure.

Once the G20, IMF and the BIS have chosen an approach to what will become a new global reserve currency the question will arise on how it is to be managed. A service-oriented (SOA) appears to offer a significant approach to a management system. SOA can identify and promote the shared use of common capabilities across the global financial system. Under this approach, functions and applications are defined and designed as discrete and reusable capabilities or services that may be under the control of different organizational entities.

The various stakeholders who will need to participate in a information and knowledge architecture for managing a new global reserve currency must overcome numerous social, political and technology issues. A new informational and knowledge architecture can reduce or eliminate some of the issues. A SOA, due to its architecture serve can provide services which many of the participants can see as unifying without the need to give up portions of their sovereignty. The technical aspects of SOA through the use of ESB can accommodate stakeholder systems without the need to significantly modify them.

SOA's potential when unleashed can provide a significant advantage to aligning the various global financial functions. The basic concept of SOA is that it is an approach to defining integration that is architectural framework and service based. By employing a repeatable methodology and associated process to implement an architectural framework within a mature governance model, the new system for managing the reserve currency will ideally result in and ensure a most-cost effective and efficient development of this critical element of the new global financial structure.

Endnotes

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[i] Sovereign debt is also known as public debt, national debt is the debt owed by a central government, while private debt is that owed by corporations and individuals.

[ii] Both sovereign and private debts form the majority of all debt. The various types of debt can generally be categorized into: 1) secured and unsecured debt, 2) private and public debt, 3) syndicated and bilateral debt, and 4) other types of debt which are obligations owed by one party (the debtor) to a second party, the creditor.

[iii] Debts represent the debtor which are balance by the soft assets of the creditor, both have negative consequences as shown by Cardullo, M. & Lui, M. 2012. Initial Approach to Studying Global Finance. *ICFTE 2012.* Singapore.

[iv] Adherence means that the new currency will be the only currency used a global reserve.

[v] A zero-sum mentality in game theory and economic theory is a mathematical representation of a situation in which a participant's gain or loss is exactly balanced by the losses or gains of the other participant(s), i.e. "beggar they neighbor"

[vi] The G20 Secretariat serves as a coordinating body for meeting organization (define "meeting organization") and the research and transfer of information between members and has no other function

[vii] A carry trade involves borrowing or selling a financial instrument with a low interest rate, then using it to purchase a financial instrument with a higher interest rate.

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