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TOWARDS A KNOWLEDGE ECONOMY

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Abstract

This paper provides a preliminary formulation of a new currency based on knowledge. Through a literature review of alternative currencies, various properties and benefits are selected that we hope will enable such a currency to be created. Nowadays not only money but also knowledge is necessary to do business. For instance, knowledge about markets and consumers is highly valuable but difficult to achieve, and even more difficult to store, transport or trade. The basic premise of this proposal is a knowledge measurement pattern that is formulated as a new alternative social currency. Therefore, it is an additional means of contributing to the worldwide evolution of a knowledge society. It is intended as a currency to facilitate the conservation and storage of knowledge, and its organization and categorization, but mainly its exploitation and transference.

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TOWARDS A KNOWLEDGE CURRENCY

1. INTRODUCTION

The world is changing, and the changes are guided by human activities. People form individual opinions on the desirability of human activities and how to guide and control them. Thus, according to Lietaer [2001], we are living through a major mutation of the social–economic fabric of our global civilization. This mutation is a result of human knowledge, because people think and are able to act according to their thoughts. For example, people may reach a consensus about what activities are beneficial to the earth and its inhabitants, or which activities are harmful and should be avoided. For that reason, we believe that people's knowledge will be responsible for creating, modifying, and maintaining the global physical and mental infrastructure of humanity.

On the other hand, knowledge has become a necessary factor, like work or capital [Boisot and Canals, 2004; Moulier, 2004]. For that reason, the contribution of Cornasi [1992, 2002] is important because he states that work generates knowledge, in addition to knowledge generating value. In addition, there are some people who declare that knowledge is the new standard world currency. Therefore, they believe that in the future, knowledge may possibly be transformed into money, and be considered universally satisfactory [Celaya, 2005].

In the world at present, there are different forms of exchange. There are alternative currencies such as social and digital currencies, as well as local exchange trade systems. In addition, hundreds of projects to entirely computerize local national currencies as well as newer forms of private currency are underway [Lietaer, 2001].

Moreover, as in the experience of BookMooch [Buckman, 2006], knowledge is encapsulated in books, each of which has a value, and other activities revolve around it. In this paper we show the first and preliminary formulation where knowledge is encapsulated and explain how transactions and payment might work, all with respect to the currency that will be defined.

It is important to know that the main concept in this paper is a bank (a utopia) where people deposit their knowledge, which we call "wits", and withdraw it with extra knowledge compensation. The benefits of such a "Bank of Wits" are the same as those of money banks, which in previous centuries facilitated the flow of money to empower trade and business.

This paper will take the first steps in formulating this proposal. In four sections, the initial characteristics and properties of the new currency will be described. Section 2 describes the contributions of the literature review, comparing several alternative currencies, and provides the theoretical background that is discussed in Section 3. In addition, this section contains the preliminary characterization of the new currency. Finally, our conclusions and the implications for future research are presented in Section 4.

2. REVIEWING THE LITERATURE ON COMMUNITY CURRENCIES

This section describes knowledge as something that can be "represented" with a schema yet to be discovered. Some think of knowledge as something that can be acquired by automated methods [Boutang, 2004]. The position of our proposal is that knowledge must be measured in a quantitative way.

Currently, specific communities have their own medium of exchange. This is generally accepted by economists, and was most notably proposed by a former member of the Central Bank of Belgium, Bernard Lieater [Van Gelder, 1998], who affirms that in the present monetary system there are and will continue to be alternative and complementary monetary systems.

- **Social Currencies:** Turning to different alternative currencies, one can see how social currencies offer a new economic model for communities that decide to complement their normal economical activities supported by local economic systems based on abundance and solidarity [Calvo, 1977].
- **Digital Currencies:** Digital gold currency (or DGC) is a form of electronic money denominated by weight of gold. The typical unit of account for such currency is the gold gram or the troy ounce, although other units such as the gold dinar are sometimes used. DGCs are backed by gold through unallocated or allocated gold storage [Wikipedia, 2007]. The Gold Economy Magazine believes that digital currencies will prove to be as world changing as the inventions of the printing press or gunpowder. Digital Currencies link financial institutions and markets across the globe in a way that allows instantaneous value transfers with a fraction of the cost associated with traditional bank wires and credit cards [The Gold Economy Magazine, 2005].
- **Digital Cash:** Digital cash is a system that allows a person to pay for goods or services by transmitting a number from one computer to another. Like the serial numbers on real dollar bills, digital cash numbers are unique. One of the key features of digital cash is that, like real cash, it is anonymous and reusable [Webopedia, 2007]. According to Manotis [1995], this kind of currency, even when it is created without state laws, is intended to be the exchange type for e-commerce.
- **Virtual Currencies in Online Games:** These are currencies in worlds of fiction. Fictional currencies are used in movies, novels, television series, manga, anime, computer games, and so on. Generic money of this type is typically constructed from one or more precious or semiprecious metals, such as copper, silver, gold, electrum, or even platinum, followed by coins or pieces [Wikipedia, 2006].

In addition, the most common social currency is the Bank of Time[1], which is the first bank that works without money. It is a new concept of interrelations that improves welfare and cooperation in our community. A person deposits some hours of his/her time offering a service, and in return can ask for time from other people to resolve his/her needs. All the interchanges have the same value: time. The exchanges are agreed and are always voluntary [The Murcia City Council, 2007].

According to one theory, there are common properties and benefits between alternative currencies and local currency; thus, we can infer the properties and benefits from a social currency. Table 1 gives is a summary of properties and benefits of local and alternative currencies. To understand the following table it is necessary to note the properties of a local currency, which are anonymity (it does not identify the transaction agent), uniformity (it does not reveal transaction characteristics), and dynamism (it circulates indefinitely) [Salvat, 1973].

Table 1. Properties and Benefits
Alternative Currencies

	Social Currencies	Digital Currencies	Digital Cash	Virtual Currencies in Online Games
Monetary Unit	Hours, voucher, services, goods, token, etc.	Grams of gold or grams of silver	In local currencies	Its equivalences
PROPERTIES				
Properties – Local Currency				
Anonymous	No	Yes	Yes	Yes
Uniform	No	No	Yes	Yes
Dynamic	Yes- If the user wants	Yes- If the user wants	Yes- If the user wants	Yes
Properties – Alternative Currencies				
Solidarity	Yes	No	No	No
Monetary character	No	Yes	Yes	Yes
Local abundance	Yes	Yes	No	No
International	No	Yes	Yes	Yes
Cheaper	Yes	No	No	No
Agility	Yes	Yes	Yes	Yes
Payment person to person	Maybe	Yes	Yes	Yes
Security	No	Yes	Yes	Yes
Anonymous	No	Yes	Yes	Yes
Infinity	Yes- If the user wants	Yes- If the user wants	Yes- If the user wants	Yes
Privacy	No	Yes	Yes	Yes
Divisible	No	Yes	Yes	No
Free of monetary politics	Yes	No	Yes	Yes
BENEFITS				
Groups Dynamization	Yes	Yes	No	Maybe
Availability	Yes	Yes	Yes	Yes
Speed	Maybe	Yes	Yes	No
Best relationship	Yes	Yes	No	No

Inside the world of alternative currencies, the following diverse patterns of measurements exist. An hour of service is the basic unit in banks of time; goods and services are used in local exchange systems and often inside these systems, which can be measured in a local currency or in special bills (such as in board games), that a person can use to pay or be paid.

In the first place, we have to analyze the monetary unit that is exchanged because any kind of alternative currency is different from others. When we compare Table 1 with Table 2, it can be seen that knowledge has not been used as medium of exchange. In addition, Table 2 shows different monetary units that can be used in future applications of the new currency based on knowledge (see the next section).

Properties have been divided in two parts: first, local currency properties mean that alternative currencies are not intended to replace local currencies, but have only some of the above properties. Second, alternative currency properties mean that a currency may or may not have all properties.

The first property, *Dynamism,* is that a currency circulates indefinitely; in the case of alternative currencies it means that it circulates for as long as the user decides, because he/she is free to choose when to leave the alternative community. Table 2 suggests the same conclusion; user permanence in such a community is indefinite until he/she decides otherwise.

The other two local currency properties—*Uniformity* and *Anonymity*—are not possessed by social currencies, but tend to be possessed by the others. In a special case—virtual currencies in online games—three properties are fulfilled, because they are generated and act as local currency, but are developed in virtual worlds.

Now, with regard to alternative currency properties, *Solidarity* can be omitted. It is possessed only by social currencies, because being a social currency is its main objective, and therefore is the only one that has no *Monetary Character*, because its philosophy excludes monetary aspects.

Another important detail is that two properties (*Agility* and *Payment person to person*) are possessed by all alternative currencies. These two properties are consistent, because in some transactions there are no intermediaries and relationships can be made person to person.

The *Infinity* property of alternative currencies is similar to *Dynamism* of local currencies, because it refers to circulation time, and in both cases is determined by users' requirements. This means that each member of a community with an alternative currency may independently choose the duration of his/her membership and can decide the moment to resign.

Privacy level is inseparable from security rates that must be provided by users. In social currencies the level is not null, but the other kinds of alternative currencies have a higher level; these *Privacy* and *Security* levels increase directly in proportion to the utilization of the local currency, digital currencies in relation to grams of gold and/or silver, and in the case of digital cash, local currencies.

Regarding *Benefits*, social and digital currencies improve relations because they allow closer interaction among community members. The opposite happens with digital cash and virtual currencies in online games.

Four currency modalities are available when users interact, although digital currencies and digital cash can be utilized faster, because they are available on the Internet at any time.

Virtual currencies in online games, as well as local currencies, generate *Benefits* for the community where they belong. They can exhibit dynamism when the number of users increases.

Table 2. Properties and Benefits
Knowledge Currency

	Knowledge Currency
Monetary Unit	User Knowledge (marketing), Citations (peer-review), Public Administration Knowledge (e-government), etc.
PROPERTIES	
Properties – Local Currency	
Anonymous	No
Uniform	Yes
Dynamic	Yes- If the user wants
Properties – Alternative Currencies	
Solidarity	Yes
Monetary Character	No
Local Abundance	Yes
International	Yes
Cheaper	Yes
Agility	Yes
Payment Person to Person	Yes
Security	Yes
Anonymous	No
Infinity	Yes - f the user wants
Privacy	Yes
Divisible	Yes
Free of Monetary Politics	Yes
BENEFITS	
Groups Dynamization	Yes
Availability	Yes
Speed	Yes
Best Relationship	Yes

In conclusion:

- Knowledge is among people, so the idea of using knowledge as currency is a way to prevent its extinction.

- The currency proposed in this paper cannot be classified [Blanc, 1998]. Rather, it is considered a social currency because its main foundation is *Solidarity*. In any case, it could be the first technologically developed social currency.
- Alternative currencies make sense socially, economically, and from a business viewpoint.
- Alternative currencies make possible transactions and exchanges that otherwise would not occur.

Studying different modalities of alternative currencies and others' experiences, it has been shown here that any new currency such as "Wits" could have the characteristics of all of them. What is proposed, therefore, is an interactive, innovative, and unique currency that uses knowledge as a standard measure and further contributes to the emergence of the knowledge society.

It is important to know that the properties in Table 2 could be those of the new currency or not, depending on the model that will be defined.

From social currencies, the solidarity character will be the principal one assumed. From digital currencies, the international character will be assumed, because it does not have frontiers and it is possible to access it anywhere in the world. According to Table 2, they coincide with other properties such as local abundance, agility, person-to-person payment, security, infinity, privacy, and divisibility.

From digital cash, as well as the previous classification, an international property can be claimed because it does not have frontiers and it is possible to access this currency anywhere in the world. According to Table 2, it coincides with other properties such as: agility, person-to-person payment, security, infinity, privacy, divisibility, and freedom from monetary policies.

As virtual currencies in online games work in fictional worlds, to implement the new currency it is necessary to define behaviors that frame a specific community; according to Table 2 it coincides, in addition, with the following properties: international presence, agility, person-to-person payment, security, infinity, privacy, and freedom from monetary policies.

Thus, alternative currencies have some properties that we can describe in the new currency, as follows:

- **Solidarity and local abundance:** Who possesses knowledge and can help and/or sponsor a person that needs it.
- **International presence:** This is necessary to cross borders and provide access at any place in the world.
- **Cheapness:** All contributions will just be knowledge, not in local currencies.
- **Agility:** This allows access to the knowledge currency at any moment.
- **Person-to-person payment:** This is the possibility of performing transactions without mediators and in the new currency that actually exists.
- **Security:** Even if the knowledge currency is free of monetary policies, it must be reliable for each function.
- **Infinite:** Users determine the duration of this currency as they decide the moment to deposit or withdraw their knowledge from the bank.
- **Privacy:** The knowledge deposited in the bank will not be public knowledge.

- **Divisible:** One unit could be divided in multiple ways, depending on the application and method of division.

Following the comparison, knowledge may be converted into a new currency. There is an impressive amount of research on closely related subjects in many economic areas such as management, human resources, marketing, and artificial intelligence. Only in artificial intelligence is there extensive work on knowledge management, semantic webs, intelligent agents, expert systems, case-based reasoning, electronic institutions, etc. However, all these approaches have the same deficiency: they think of knowledge as qualitative (nonquantitative), impossible to measure differently from "a lot of" or "no" knowledge. The position of the proposal in this paper is that knowledge has to be measured in a quantitative way, in quanta.

As in the experience of BookMooch [Buckman, 2006] knowledge is encapsulated in books. Each book has a value and all the activity revolves around it; in this paper we describe properties and features to encapsulate knowledge, and a series of transactions and payments are developed around the currency that it is defined.

Now the question is: Can knowledge be a monetary object?

According to Salvat [1973], currency has three characteristics, and according to Sieber [1999] knowledge also has three basic features. Each feature of currency can be related to one of knowledge, and this relation is the basis of this approach to the new currency characterization:

Currency	**vs**	**Knowledge**
Anonymous		Personal
Uniform		Consumable
Dynamic		Utilitarian

- **Interpersonal:** Relating the anonymity of currency to the personal nature of knowledge we find the *interpersonal* aspect, which acknowledges the origin of knowledge and permits its transmission, use, and benefits.
- **Shareable:** Transferring knowledge does not mean giving all of it, as with local money. Rather, it is assumed to be shared, and the benefits of exchange are delayed. Setting knowledge in movement is not losing it, but causing it to grow.
- **Indefinite:** Dynamics of currency implies indefinite circulation: use of knowledge and as a consequence its circulation. Knowledge is in the hands of its initial owner, who decides when and how long it will be in circulation.

Knowledge starts from senses, passes to understanding, and finishes in reason; furthermore, its value depends on the environment in which it moves. Specifically for this proposal, knowledge requires the following typology to be encapsulated:

- **A posteriori:** It is derived from senses and past experiences.
- **Codified:** It can be stored or formally specified in order not to lose it.
- **Public:** To be a created knowledge/well known to, and for, society, knowledge is public and in this way it can be shared.
- **Global:** It does not require any specific geographic location, but can be formed by a network or a community around the world.
- **Explicit:** It can be transmitted from one person to another and be understood.

- **Scientific:** It must be the result of experience and proved by the existence of principles and laws.
- **Collective:** For knowledge to become monetary, a target community must be defined to implement the new currency.

3. PRELIMINARY DEVELOPMENTS

It is necessary to analyze three different areas: economy, social, and technology.

First, however, it is important to note that the radical novelty of this approach is that the *wit* is defined as a unit that is exchangeable. As noted above, the Knowledge Bank ("Bank of Wits") will be a utopia, where juridical and physical people deposit their knowledge, which we call "wits", and withdraw the knowledge with further knowledge compensation, instead of converting knowledge into existing currencies [Carrillo, 2006a]. Therefore, a correlation between world economic and knowledge growth has been claimed [Boutang, 2004].

3.1. Economic Development

Basic economic concepts will be taken into consideration, because they are the background to the preliminary definitions of the new alternative economic system.

The inflation concept in any economy is a phenomenon that gives rise to a quick increase, constant and extremely unequal, in prices of merchandise. In the case of knowledge, inflation is a consequence of the existence of excessive amounts of currency.

Possible causes of inflation in the new alternative economic system:

- An increase of demand for knowledge.
- A reduction of deposits of knowledge.
- An increase in the circulation speed of knowledge.
- An increase in the quantity of knowledge. This increase does not have an inflationary effect as long as knowledge demand increases proportionally. Inflation is a monetary phenomenon, because if knowledge increases, purchasing power also increases and causes inflation.

Inflation, in a traditional economic system, is a result of price increases that can occur with any currency. The knowledge currency will be proposed as a social currency that, depending on the environment where it is developed and applied, will have a destination community and a specific use. Use of knowledge at present does not correspond to purchase of goods and services. This is because inflation depends on rising prices of goods and services, and in this proposal does not affect behavior of this new system because, according to a suggestion regarding the state of the art, the knowledge currency is not intended to replace national currencies.

Possible consequences in the new alternative economic system:

- With the inflationary effect, poor people have less and rich people have more.
- Those who have debts with the "Bank of Wits" in some periods of high inflation rates end up gaining money because of money devaluation. Purchasing value varies over time.

- With revised inflation rates, the "Bank of Wits" would be harmed because it has borrowed money that has a value at a particular date, and when it is returned the value would not be the same. It will receive money with low purchasing power.
- The currency is strongly affected by credit, because when inflation is increasing, the interest rate also increases.

Some solutions:

In cases of high inflation, interest rates should be increased to stop money flows through the economy; this entails increasing the interest price of loans.

In a traditional economy, economic growth is measured according to increases in income and society's quality of life. Furthermore, different factors such as investments, interest ratings, consumption levels, savings, and politics must be taken into account.

Generally, growth is measured by comparison of historical and modern economies. There has never been any currency based on knowledge, so there is no basis for comparison. Therefore, the mechanism to measure this growth in different periods of time must precede our own system. Interest rates, consumption, savings, and inflation levels will be analyzed to determine growth.

In a traditional economy, economic growth is a comparison of the current year with the previous one. Now, in the new alternative economic system, the way to measure increase is by counting the number of users of a bank, because this indicates that the system is expanding and that users trust it.

3.2. Social Development

In a world where there are many shared experiences, a common approach to social development exists and this is one of the main contributions that we want to include in our proposal. Solidarity exists in diverse alternative currencies, mainly social currencies; for example, diverse banks of time[2] [TimeBanks, 1990], and local exchange systems that operate in several countries.

In the social field, solidarity is one objective of this proposal. For that reason, the basic premise of the new currency is a knowledge measurement pattern that is formulated as a new alternative social currency. Therefore, it is a first step in contributing to the worldwide evolution of a knowledge society.

3.3. Technological Development

Throughout history, knowledge has been generated exclusively by humans, but now machines (e.g., through data mining and intelligent infoagents) are beginning to generate knowledge and to become vectors of knowledge [Cornella, 2005].

We initiated this proposal taking knowledge as a pattern of measurement of a new social currency, and to contribute to the evolution of the world toward a knowledge society. Our currency will be denoted by the symbol ⍟ [Carrillo, 2006a].

To characterize our currency and develop an appropriate economic system, the following stages of knowledge management are considered: capture, conservation, organization, processing, and dissemination. Because these stages fit perfectly with each level of the

evolutionary processes of currencies in economic history, a parallel with each stage will be established and the necessary techniques and tools will be applied to represent each stage. These stages are generation, storage, transportation, and distribution. In parallel with these, the project will be conducted as follows [Carrillo, 2006a].

Generation/Extraction: Generation of knowledge is an economic activity like any other. This generation can be acquired by reasoning, discovery, scientific research, and from the Internet, books, experts, etc. In addition, certain attitudes exist that stimulate knowledge; these are reflection and critical thought. At the level of techniques for machine learning, processes of data mining such as an interactive model for extraction of knowledge from a great amount of data can be used. People have adopted machines and vectors of knowledge and forget that previously only humans could generate knowledge [Carrillo, 2006a].

Storage/Conservation: Storage will be dealt with in the same way as alternative currencies. It will be achieved in a similar way to a traditional bank, in which each user will have an account, through which income and outgoings are controlled.

When machines can generate knowledge, we will attempt to replicate a technological bank to manage the new currency. Having established characteristics and rules that allow interactive and innovative operations, there will be a site for storing the knowledge generated in the previous stage. From this stage, an interconnection system controls safe transmission of the knowledge to the bank [Carrillo, 2006a].

Transport: In the case of knowledge, the monetary unit will be denoted as $\not{\text{K}}$, in which K represents *knowledge* that has been locked in, showing that knowledge has been encapsulated, and the slash that crosses it is intended to show how this knowledge becomes a monetary value [Carrillo, 2006b].

Transferred knowledge in BookMooch [Buckman, 2006] is encapsulated in books, where each book and each activity turns around it, and is valued in points regardless of theme, extension, or antiquity, etc. Furthermore, to consolidate possible application in a concrete form, knowledge will be encapsulated and all operations and developments of the bank are based on this.

To transport the knowledge, a common language and common ontologies are required to enable understanding. During this stage, knowledge transport within the bank, according to some of the protocols and characterizations of a traditional bank, and other protocols according to specifications of our new alternative social currency occurs [Carrillo, 2006a].

Use/Consumption: In this stage, knowledge will move, because it is in this stage that knowledge loans, and later collection of interest from this activity, and traditional banking transactions occur [Carrillo, 2006a].

3.4. Possible Applications

In the future development of this proposal, we shall ask “a pointer is the currency?” that an agent can use to point to knowledge, or solutions and benefits. That means that wealth is represented by numbers of pointers. A pointer can represent any modality of knowledge, and according to each possible application, a pointer can be defined as follows:

Pointer's Representation	Future Application
[Ref.]	General Pointer [Carrillo, 2006a]
[Ref., Recommender Agent]	Bank of User Knowledge (BoUK)
[Ref., Citation]	Citations Auctions [de la Rosa, 2006]
[Ref., subjective evaluations]	The Market for Evaluations [Avery, 1999]
[Ref., citizen knowledge]	e-Government [Moreno, 2006]
[Ref., BD]	Query Processing
[Ref., Trust]	Trunits [Kerr, 2007]

According to each application, the pointer can be different. That is to say, the basis of the pointer is already defined; the difference is the knowledge or the service at which it points. For example, in case of the Bank of User Knowledge, the pointer is the Recommender Agent who has the user model.

4. CONCLUSIONS AND FUTURE WORK

According to the literature review, our proposal can be considered a new alternative currency, because the properties were defined as a result of a comparison between properties of alternative currencies.

This paper is the result of a literature review and is, therefore, the first step in the formulation of a new economic model. It introduces, in a general way, all the characteristics that knowledge must have to be converted into a new currency and also the new properties and characteristics that the new currency unit will have when established.

In the near future, it will be important to theorize, describe, and simulate the final characteristics, properties, and rules of the new social currency and its bank. Thus, an application with a specific context, such as citation auctions, including defining the scene, specific rules, and behavior that can occur in the application, needs to be developed. Ultimately, our intention is to design experiments and methods to prove the implementation.

The new currency will assist business development because it will make knowledge move. Instead of having knowledge in their brains or systems, people will invest their knowledge ("wits") in businesses, expecting to gain more knowledge. Knowledge that does not move will suffer, similarly to money, and suffer severe depreciation. Businesses need not only money but also knowledge to survive. Therefore, the results of this project will be the basic, but crucial, research to set the foundations of a new business model that requires new technology and new social thinking.

ENDNOTES

1. The Bank of Time seeks to build local economies and communities that reward decency, caring, and a passion for justice by developing, testing, and assisting experiments with a new medium of exchange called "Time" (also known as service credits or time banking.) One hour helping others equals one unit of Time Currency.

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