The Design of Innovative Mobile Artifacts: How to Develop Powerful Value Networks?

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Abstract – The development of mobile data services and products calls for participation and collaboration amongst many actors with different expertise. However, building powerful value network is challenging and requires a detailed examination of a number of design constructs and their interrelationships. This research provides an intuitive model to help effectively design such networks. The model is illustrated using NTT DoCoMo’s i-mode case. It is argued that the model offers a useful methodical approach for telecoms providers to develop a thriving value network capable of creating significant mobile innovations and benefits.

Keywords – mobile data services and products, mobile communications, value network, i-mode.

I. INTRODUCTION

Mobile telecommunication providers (from now on shortened to telecoms) are increasingly placing more emphasis on providing data services rather than voice services. This is because telecoms consider that the number and types of artifacts (i.e. services and products) that can be developed on the basis of data are more profitable than those that can be created on the basis of voice. This highlights the strategic importance of data artifacts to telecoms as they attempt to expand their customer bases and generate more income, especially with the saturation of the voice market and the recent recession.

Designing and engineering mobile data service is a complex undertaking, and usually requires the involvement of multiple parties, rather than a single telecom. These parties form the so-called ‘value network’ for innovation. The main aim of value network actors is to collectively create enhanced value to customers and hence maximize the value for each party involved. However, developing a successful value network is not easy. It is a multifaceted process that requires a thorough examination of a number of critical concepts, along with their interrelationships. Based on research this paper proposes a model that provides a methodical approach for telecoms to develop a powerful value network that helps maximize the development of innovations.

The paper is structured as follows. First, a background of the telecom industry and value networks is provided. Then, the research methods are described. Thereafter, the proposed model for value network design is discussed, showing its design constructs and their interrelationships. This is followed by an illustrative case concerning NTT DoCoMo’s i-mode service, providing a real-life explanation of the model. Lastly, we summarize and outline the paper’s contributions.

II. INDUSTRY BACKGROUND AND VALUE NETWORKS

The mobile telecommunication business is undergoing a major revolution, driven by innovative technologies and other issues related to globalization. This has led to the shift from one simple voice service to a portfolio of mainly convergent services that integrate voice, data, and Internet technologies. This shift towards mobile data communication services, such as location-based services and mCommerce, is closely linked with the shift from individually developed telecoms services to multiple partnerships, and from simple and linear links to complex relationships between the parties [1].

Indeed, the structure of the mobile telecommunications industry is shifting from an ‘autocratic’ state to a more ‘democratic’ one where a more complex and open system, including extensive collaboration, communication, and co-ordination, is prevalent. This is changing the business rules of the telecommunications industry. For instance, cellular infrastructure deployment is no longer a major problem, but how to co-operate to launch services efficiently and effectively is much more of a concern [2,3].

As a result analyzing the mobile telecommunications industry in terms of a ‘value chain’ is no longer an appropriate or valid mechanism [2,4,5,6] and to cope with this more complex open and collaborative environment the concept of value network has emerged as a more appropriate analytical lens [7,8,1].

Designing powerful value systems is critical to the success of mobile data artifacts [7,9]. For example, in explaining why i-mode service is generating high revenues in Japan, while mobile data services in Europe and USA are struggling, Takeshi Natsuno, NTT DoCoMo’s managing director for i-mode services, argues that the issue is related to market arrangements and structure [10]. Developing effective value network in this new environment is very challenging as it includes actors and issues not necessarily under the control of the telecoms.

III. RESEARCH DESIGN

To analytically develop a model for creating powerful value networks relevant to the design and engineering of innovative mobile artifacts it is necessary to collect data from multiple sources. The main source in this research was 21 semi-structured interviews with key practitioners (i.e. managers) in the telecommunications sector.
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Interviews were recorded and on average lasted about 90 minutes. The interviews were transcribed, verified, and then analyzed.

Further sources were observation and documentation. Analyzed documents include annual and internal reports, market research, internal presentation material, companies’ websites, and other documents related to the design of mobile services. Some of the data collected and analyzed relate to other case studies conducted as a part of a broader research program, beyond the scope of this paper. In line with [11] this “triangulation” was found useful as it allows ‘cross-checking’ which strengthens data validity.

The collected data has been utilized to develop a logical representation of the phenomenon under investigation in the form of a conceptual model, represented in UML. Thereafter, a real-life illustration of the developed model is provided by mapping its design constructs and relationships to their counterparts utilizing the case of NTT DoCoMo’s i-mode to show its practical utility and significance. For the purpose of this paper, the collected data concerning the i-mode case are mainly adapted from [12].

IV. A MODEL FOR VALUE NETWORK DESIGN

The concept of value network is best perceived and presented as a ‘multi-party stakeholder network’ [13] as it depicts the important cross-company and inter-organization perspective required for creating and capturing value from innovation. This supports the way in which transactions are enabled through the coordination and collaboration amongst multiple companies and stakeholders [8,9].

![Fig. 1. A UML Representation of the Model.](image)

The decision of whether to follow an open or a closed network mode affects the success of the developed mobile data artifacts. From our standpoint, neither a closed nor an open mode guarantees absolute success. It is the best match between the telecom’s attributes and the features of the two collaboration models that allows telecoms to engineer more innovative mobile data artifacts.

(1) NETWORK-MODE: Concerns the development of innovative mobile artifacts, telecoms can create networks ranging from fully open to totally close. The design of open networks implies that any actor can participate with activities and by offering ideas. On the contrary closed networks mean contributions can only come from a selected number of actors who are eligible to participate. Choosing the best mode for a network is challenging as different settings and requirements call for different configurations.

Some argue that open networks [14] is the way to thrive in the new innovation landscape because open networks allow firms to harness external ideas, whilst at the same time leveraging their in-house R&D. On the other hand [15] argues that there is no one single approach that is successful at all times and in all situations. The applied analysis in this research indicates support for this view. For example, SMS and WAP have both been developed following an open mode. Whilst SMS is recognized as a massive success, WAP is largely considered a failure [16]. On the other hand, i-mode services and the iPhone have been developed following a closed mode and are both considered successful (although i-mode service is not perceived so outside Japan) [17]. In retrospect, we postulate that each network mode has its own trade-offs; thus telecoms has to choose what best suits their settings, as illustrated in Table I.

<table>
<thead>
<tr>
<th>Network Modes (Compiled after [15])</th>
<th>Mode</th>
<th>Advantages</th>
<th>Challenges</th>
<th>When to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>• Attract a wide range of knowledge domains.</td>
<td>• Screening ideas is time-consuming and expensive.</td>
<td>• You can evaluate the proposed solutions cheaply.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• You have to fully identify user and market requirements.</td>
<td>• Aligning different objectives of participants is more challenging.</td>
<td>• The requirements are not well-defined.</td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>• You receive the best solution easier and quicker as contributions are most likely to be more qualified and trusted.</td>
<td>• You have to know how to identify the right knowledge domains and pick the right actors.</td>
<td>• You need a small number of problem solvers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• You have to fully identify user and market requirements.</td>
<td>• You have to draw on.</td>
<td>• You know which actors to draw on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• You can afford the possibility of losing valuable opportunities.</td>
<td>• You know the needed knowledge domain.</td>
<td>• You have the requirements well-defined.</td>
<td></td>
</tr>
</tbody>
</table>

The applied analysis in this research reveals that if telecoms are to effectively design powerful value networks, they need to methodically examine seven design constructs and their interrelationships (see Figure 1). The identified design constructs are as follows: (1) NETWORK-MODE; (2) ACTOR; (3) ROLE; (4) RELATIONSHIP; (5) FLOW-COMMUNICATION; (6) CHANNEL; and (7) GOVERNANCE. The issues to be delineated while considering each design construct and their relations to other constructs are discussed below.
ones are to be implemented. Thereafter, parties who have provided the ideas to be implemented will be regarded as the network actors. But, if the telecom is pursuing a closed network mode, then the telecom would be able to immediately identify the actors to be involved based on the defined requirements.

In both cases, the next step is to explicitly define the knowledge domain(s) of each actor and link the actor with the requirement(s) it would contribute to. This would eventually identify the positions of actors in the entire value system and their possible contributions.

The ‘ACTOR’ concept however does not only include business partners, but extends to customers and even competitors. Examples of business actors include engineering equipment and cellular infrastructure vendors, IS-IT application vendors, manufacturers of cellular devices, content providers and aggregators, telecoms retailers, intermediaries, distributors, and ISPs. Other actors which might provide complementary services also need to be identified. For example, in the case of provisioning mCommerce services, telecoms establish relationships with actors from the financial sector (e.g. banks) to handle and manage payments and billing issues. Telecommunication regulatory commissions are playing key roles in deriving and shaping the telecom sector and thus these legal bodies are also considered key actors with which telecoms need to interact and obey [7].

The benefits arising from participating in such value networks are not achieved easily; as actors might pursue different business logics, and chase different strategic goals and objectives within the collaborations [5,8]. Therefore, actors need to align their strategic outcomes and ensure consistency, so as to successfully capture value from the collaboration.

(3) ROLE: Describing the main role(s) of each actor is the main theme of this design construct. While the role of different customers could be simply described as service supplicants, they could also play different significant roles in developing the artifact. However, the roles played by enterprise actors are much more varied; thus we place emphasis on this issue.

This research distinguishes between ‘functional’ and ‘strategic’ roles played by enterprise business actors in telecoms value networks. The functional roles of actors are diverse based on their knowledge domain, experience, and specialty. For example, the functional role of content providers may be defined as creating and supplying original content in the form of text, audio, graphics, and/or video, whereas the functional role of equipment vendors could be defined as providing cellular radio infrastructure, devices, network applications, and/or handsets. Furthermore, actors in the value network might also play contributing functional roles in service-product provisioning, and mediating roles between the telecom and its target segment in which they provide channels and functions such as distribution, sales and marketing, and after-sales. Banks may provide a source of finance in terms of loans and credits to establish, expand and run the telecom business. They can also act as payment gateways in which they manage issues related to payments and reconciliations. Further, regulatory bodies play major roles concerning pricing, entry to market, competition regulations, patents, and intellectual properties.

The “strategic” roles on the other hand refer to what key objectives and benefits a telecom is seeking to achieve by having a particular actor within its value network. The combined strategic roles played by all actors signify the main motives for telecoms to create and form their own value network. This research identifies seven main strategic roles as follows.

- **Resource Allocation**: principally, telecoms may not have sufficient resources to offer competitive and novel artifacts. Thus, they establish relationships with different economic actors to get access to external resources and link them to their own assets. Sometimes, building relationships with particular actors is not a choice but a necessity. This is mostly the case when the situation includes rare resources, patents, and the existence of technological fabrication secrets [9].
- **Efficiency**: consistent with transaction-cost theory [18] telecoms may find it more efficient to collaborate with other business actors to acquire resources and specialized skills.
- **Risk Mitigation**: when the cost of investment is large and success is not guaranteed, it may be advantageous for telecoms to cooperate with partners to create new artifacts rather than doing it by themselves. This factor has become of particular importance in the current economic downturn.
- **Effectiveness**: telecoms may recognize that launching new artifacts might require some specialized feature to make it unique and competitive. Telecoms in such cases may find it more effective to add a new actor possessing such distinctive resources and capabilities in order to launch competitive, high quality services and products.
- **Time-to-Market**: the telecommunication sector is highly competitive and time-to-market has become one of the main objectives for sustainable competitive advantages by being market leaders and pioneers. Many ideas for new artifacts are shared amongst telecoms where the role of each is not only to find the most appropriate artifacts to launch, but also to launch them before other rivals do. Thus telecoms may approach new actors if they could aid in shortening an artifact’s time to market.
- **Agility**: In the dynamic and fast growing telecommunication sector, value network formation might be the best way of achieving flexibility and providing faster response to changing needs.
- **Intelligence**: telecoms through collaboration, cooperation and joint R&D can create intelligence in relation to new opportunities and means of creating, delivering, and exchanging advanced value.

Understanding roles allows a telecom not only to identify its position within the network, but also the positions of other actors. This is pertinent as it gives a better indication of the possible value to be captured by
the telecom. This issue is also important as it helps telecos to understanding, managing, and controlling its different links with the various actors in its value network. Further, this method of analysis allows a telecom to accurately identify the functional and strategic contributions of each actor. The size of each actor’s contribution should be reflected in its proportion of the captured value so as to keep the business network healthy and sustainable.

**RELATIONSHIP:** This design construct is about identifying the sorts of links telecoms need to establish with their value network actors. The relationships between telecoms and network actors could take the form of strategic alliances and partnerships, affiliations, joint ventures, mergers, acquisitions, or any other sourcing type. The importance of role(s) that each actor plays indicates the appropriate kind of relationship the telecom needs to build with that actor. For example, sourcing relationship seems sensible for acquiring middleware and other software systems, whilst some sort of strategic partnership might be more rational when establishing an association with actors like content and internet service providers, as their roles are more substantial in mobile data services.

The kind of relationships telecoms develop and maintain with their customers represents another facet in this concept. Customers are the main source of revenue; thus creating positive relationship dynamics with them is vital, as it helps create customer intimacy and lock-in [7].

**FLOW-COMMUNICATION:** This concept addresses the objects communicated amongst various actors connected in value networks. It helps artifact designers to represent value exchange streams amongst the economic actors to make them more controllable, manageable and effective.

The importance of this construct comes from the fact that ‘relationships’ with different actors are enriched by materials communicated between them. These materials can take the form of information, knowledge, money, products, services, hardware, software, documents, agreements, and any other relevant objects. There are two scenarios for objects’ communication or flow; objects flowing between (1) telecoms and customers, and (2) telecoms and enterprise actors. In the former case telecoms may create intelligence by collecting information about customers and potential customers. Consequently, they provide them with purposeful artifacts. In response, customers allow telecoms along with other network actors to capture value via payments and providing other benefits such as feedback information. In the latter case content flows from content provider to content aggregator. The aggregator may cleanse, format, edit, customize and combine relevant content and communicate it to telecoms to be used by services. After revenue is generated, each participating actor receives its share from the captured value.

**CHANNEL:** Examining the communication mediums or ports used to communicate materials amongst other actors as a result of their relationships is the main theme of this design construct. Channels could be physical or electronic, and can range from being manual to fully-automated, where technological systems talk directly to each other. It is important for telecoms to employ varied channels since communication ports are used with different actors for different functions such as customer relationship management, collaboration and communication, distribution and logistics, customer service, and marketing.

Furthermore, arrangements in value networks include constructing interfaces with customers. In addition to physical communication channels including intermediaries, telecoms are exploiting the Internet and other associated technologies such as portals and CRM tools to develop valuable virtual communication mechanisms with their customers. The number, type, customer reach capabilities, and the quality of communication channels telecoms build and maintain with their customers and other network actors (e.g. business partners) are critical to success.

This design concept is closely related to the former one as artifact designers and engineers need to select the most appropriate channel at each single flow of materials. For example, information concerning potential customers could be communicated virtually to telecoms using software agents as channels; whilst to communicate particular mobile services to customers, special handsets maybe used as communication mediums, as in the cases of Apple iPhone and i-mode.

**GOVERNANCE:** Governance tells who has which form of control and power over what kind of object, e.g. data, relationships, channels, functions, and transactions. Typically, actors try to achieve more power and control in order to augment the value captured. Keeping track of this sort of information is important as telecoms could utilize it to (a) identify new opportunities, where they can have more power and control; (b) evaluate risks associated with existing configuration of governance, and (c) establish reference points for accountability purposes.

Value network governance could range from hierarchical governance to governance in a flattened mode. Hierarchical approaches mean that one of a few actors predominately control and manage the innovation process. The motive for this approach for governing actors is to enlarge their share of the value captured. Nonetheless, this approach is risky and may lead to catastrophic results if actors in charge do not have the necessary capabilities and knowledge to define problems and evaluate proposed solutions [15].

Managing value networks by employing a flattened method entails that all actors are sharing costs, risks, knowledge, capabilities to collectively solve the innovation problem [15]. This is normally the case when the innovation requires a wide range of knowledge domains scattered across various actors from different backgrounds. By following this governance method, the shares of the value captured across all actors are approximately the same.
Although such an approach may lead to better solutions, it is usually time-consuming as all actors need to agree on a mutually beneficial solution. This may increase the innovation ‘time-to-market’ which might negatively affect the competitiveness of the proposed innovation. Therefore, the fitting choice between hierarchical and flatten governance approaches is considered as one the elements contributing to the success of mobile data innovations.

IV. THE CASE OF NTT DoCoMo I-MODE SERVICE

The i-mode service was launched in Japan on the 22nd of February 1999 by NTT DoCoMo telecommunication provider. Despite its modest technology, i-mode was the first in the globe to succeed with a number of current users exceeding 48 millions. The i-mode data platform contains a portfolio of bundled and well-balanced entertainment, information, database, transaction, and other (e.g. email) services.

In developing the i-mode service, NTT DoCoMo has adopted a closed network mode, given that user and market requirements were clearly defined following the market research the telecom had conducted, led by marketing specialists Muri Matsunaga and Takeshi Natsuno. A closed model was also deemed appropriate as the telecom was able to determine the required knowledge domains for the i-mode service and the parties to collaborate with, given its long and sustainable relationships with many and different types of actors inside and outside the telecommunications sector. Further, NTT DoCoMo’s extensive R&D capacities as well as its wide and deep knowledge in telecommunication standards, infrastructure, services, and devices provided another reason justifying the appropriateness of a closed network mode.

NTT DoCoMo utilized its existing technologies and predominantly its dedicated packet network (PDC-P) for i-mode service. This eliminated the need to add cellular infrastructure providers to its value network. Nonetheless, the telecom recognized the need to build close cooperative relationships with many content providers to feed the service with different forms of useful and innovative content. Thanks to these collaborations, more than 95,000 websites are accessible through the i-mode menu making the service effective and powerful, and thus attracting a wider variety of customers.

As i-mode websites need to be developed using cHTML (Compact Hyper Text Markup Language) and run on a micro-browser, adding handset providers and manufacturers to i-mode value network was essential to take full advantage of the service potential. To this end, NTT DoCoMo created an environment for sharing R&D with a selected group of handset manufacturers (e.g. NEC, Sony, and Fujitsu) enabling technologies to be improved in an incremental and continuous manner, e.g. the development of Java-enabled handsets in 2001. This sort of collaboration allows the telecom to bring appropriate channels (i.e. handsets) to the market enabling users to successfully communicate with the i-mode service.

It was more efficient and more effective for NTT DoCoMo to collaborate with content providers and handset manufacturers than to play these roles itself. This is because the latter calls for huge investments and a learning curve that would most likely have (a) prevented the telecom from getting first mover advantage; and (b) eliminated the advantage of employing the existing PDC-P as a network infrastructure, that was good enough to make the service successful by then; given that technological innovations are emerging rapidly.

For NTT DoCoMo, building collaborative relationships has extended beyond the telecommunication sector to include actors from the outside. Although NTT DoCoMo is the actor handling the billing function within the i-mode value network and rewarding itself for this extra role (a 9% commission on service subscription), it has also partnered with leading banks developing new forms of payments and money collection systems. Moreover, it has also partnered with Coca-Cola, allowing i-mode users to use their handsets with Coca-Cola vending machines and charge transactions to their i-mode bills.

With the intention of making i-mode the de facto standard worldwide, NTT DoCoMo built a number of strategic partnerships with many telecoms in Asia (e.g. 3 Hong Kong and Smart in the Philippines), in Europe (e.g. KPN Mobile in the Netherlands and Wind in Italy), and in the Middle East (e.g. Cellcom Israel). NTT DoCoMo even bought a substantial share of one of the telecoms it collaborates with (a 15% of KPN) aiming to sustain the relationship and make it more powerful. To build a strong base for these international collaborations, NTT DoCoMo established in 2000 a strategic alliance with AOL-Time Warner to provide rich content and marketing in the English language.

The i-mode value network is hierarchical in its governance. NTT DoCoMo is the dominant actor directing and managing the innovation and its value creation. For example, to qualify for official status which includes having their website accessible directly through the i-mode menu, content providers are required to undergo a lengthy qualification process fully controlled by NTT DoCoMo. Another example is that NTT DoCoMo specifies in detail what kind of handsets are required to meet the requirements of the i-mode services, its updates, and developments, rather than modifying the service to meet the requirements of existing handsets.

Another important reason for the creation of a sustainable and powerful value network is related to NTT DoCoMo not being greedy and allowing actors to capture fair values based on their contributions. The i-mode network actors were not only attracted to join the network...
for financial gain but also because of i-mode’s novelty and they sought to gain knowledge, experience, and other intangible benefits in regards to mobile data service engineering.

In summary the reasons why the i-mode value network is considered successful and powerful has been explained by mapping the developed model to the case. This also provides a practical and real-life illustration of the model’s value and efficacy.

V. CONCLUSIONS

The mobile telecommunication industry is shifting from one that was all about voice transmissions to one that is increasingly about data communications. Developing mobile data artifacts requires the involvement of many actors with various backgrounds, knowledge, and expertise. However, forming a powerful value network is complex, calling for deep understanding of many concepts and their interrelationships.

This paper puts forward a novel methodical model for value network design, composed of seven design constructs and their links. This model is deemed useful as it provides a significant utility for telecoms in this context.

This paper reveals that analyzing value network concepts using the model would enable the telecom to determine its position in the value system and understand which actors to collaborate with. It is also a useful tool to examine the telecom relationships with different stakeholders. This sort of analysis is also constructive in demonstrating the roles of different actors more clearly, and showing explicitly how the value is exchanged amongst various stakeholders. Furthermore, analyzing the concept of value networks is deemed fruitful in determining whether to follow an open mode, where ideas can come from anyone, or a closed mode where only selected parties can participate. It is also valuable in explaining which governance mode to employ (hierarchical or flat) in which circumstances for best business value.

Our further research however will include the utilization of the model presented in this paper to examine a wide range of existing mobile data artefacts. We are also looking forward to utilizing the model to develop a value network for new mobile data artefacts following the action research approach. We hope that these steps will help in providing additional validation for the developed model in this research.

REFERENCES


