Value Creation and Coopetition in M2M Ecosystem - The Case of Smart City

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***Abstract*—Wireless ICT as a subcategory of the ICT industry has long been serving end users as its direct customers. The value for end users, i.e. connectivity as the end product of this industry, has been created in a linear chain where two major group of actors have been cooperating with each other: Telecom Equipment Vendors (TEV) and Mobile Network Operators (MNO). By the demand of other industries for connecting devices/machines in order to enable various services, Machine to Machine (M2M) communications and Internet of Things have emerged as new concepts where Wireless ICT could serve other industries. As a result "connectivity" became an enabler (service) and not the final product.**

In this paper we argue that linear telecom value chains are incapable of serving this new demand, since wireless ICT requires to co-create value with other industries. This causes the formation of telecom value networks in which traditional telecom actors have to form new (different) business relationships with each other; Cooperation with competitors and Competition with cooperators.

***Index Terms*—Coopetition, Co-creation, M2M, MTC, Smart City, Value Chain, Value Network.**

I. Introduction

As a means of enhancing our everyday lives, as well as a transformation tool for other industries, the Information and Communication Technology (ICT) industry has experienced a significant transformation during the past two decades [1] [2]. On one hand, this transformation relates to technological advances. On the other hand it goes beyond the ICT ecosystem, where the role of the actors and the relationships among them has been changing. Telecommunication industry –Wireless ICT–, as a subcategory of ICT industry, is no exception in this regard. If we consider Mobile Network Operators (MNO) and Telecom Equipment Vendors (TEV) as the major telecom actors in the past; these firms have experienced, and created, many changes in their business in order to adopt/cause this transformation; not to mention that new actors who entered this ecosystem have also forced some changes to the ecosystem. With regards to the presence of ICT in other industries, these new actors are mainly the industry vertical solution providers offering telecom-enabled services (SP) and Over the Top (OTT) service providers.

When it comes to the formation of the "future telecom" ecosystem, in the presence of other industries, we introduce an uncertainty that is the changes in relationships among different actors. If we consider MNOs, TEVs, and SPs as the major actors of the present telecom service provisioning ecosystem, this uncertainty boils down to the relationships among them. Different patterns of interaction among such actors have been observed. Cooperation among competing MNOs due to lack of resources, or competition over providing services among cooperating MNOs and TEVs are instances of these relationships.

In this paper we build on top of a recent work [3]. In "MTC Value Network for Smart City Ecosystems" [3] we introduced a framework in order to study the M2M activities in different setups. Based on this framework and case studies presented, we were able to introduce an abstract value network for M2M activities in the context of Smart City. As a continuation, in this paper, we discuss the business relationships among different actors of the introduced value network. We use the value network framework together with data from case studies and question what would happen if any of the three groups of actors under study –MNOs, TEVs, and SPs– perform either of the abstract activities introduced in the framework. We use Porter's five forces model (P5F) as a checklist for identifying important business relationships for the focal firm and try to determine the positions in which MNOs, TEVs, and SPs would possibly compete with each other and/or cooperate [4] [5].

In this context, this paper aims to provide useful insights on how M2M/MTC actors create value while they enter other industries as enabler/providers. In order to clarify the topic of the paper, the following research question is introduced:

- Where is the coopetition for the Telecom Actors in the Smart City ecosystem?

II. Methodology

The methodology includes a two-stage approach. The first stage provides information on practices of M2M based "smart" solutions for Smart Cities [6]. In [3] we introduced four case studies of Smart City solutions enabled by M2M/MTC, wherethey work as a basis for analysis in this work as well. We use the "ARA model" [7] as a framework to analyze the four use cases in the context of Smart City. The ARA model focuses on identifying M2M Activities, Resources associated with them, and Actors who perform activities based on the resources. The second stage provides an analysis with the objective to identify recurring patterns across different cases. The analysis is focused on producing insights into how actors cooperate and distribute their roles, and also to identify and understand drivers and obstacles for their cooperation strategies.

We also use Porter's Five Forces (P5F) framework for analyzing the market and identified business relationships. The framework looks at five specific factors that make a qualitative evaluation of a firm's strategic position, based on other firms in the industry [8]. Hence, we use this framework as a checklist to identify important business relationships that the focal firm has while considering competition and cooperation with other firms in the industry/market. In this section we first introduce the framework in brief, and then discuss how it is adopted in this paper.

For analyzing data, Analytic Induction and Grounded Theory methods will be used [9] [7]. These two are iterative methods that alternate between collections and analyses. The iterations continue until no cases dismiss the hypothesis or theory. Analytic induction stops when the hypothesis and grounded theory ends with a validated theory. Value Analysis and Empirical Data Analysis will be performed. The value analysis framework consists of conducting content analysis of collected data and studied literature in order to understand the context of the actors' decisions, intention and opinion. On the other hand, Empirical Data Analysis framework will be mainly used in order to perceive the current situation in the market and major drawback of implementing a coopetetive system.

III. M2M activities in Smart Cities

M2M and MTC are at times considered synonyms. M2M is defined as a set of wireless and wired communication between mechanical or electric devices or the communication between remote machines and central management applications [4]. In a broader scope, M2M includes all the information and communication technologies able to measure, deliver, process and react upon information in an autonomous fashion. Since MTC is the working terminology by 3GPP, it is regarded as the segment of M2M carried over cellular networks [4]. MTC in Smart Cities then refers to the exchange of information over cellular networks between autonomous devices in control

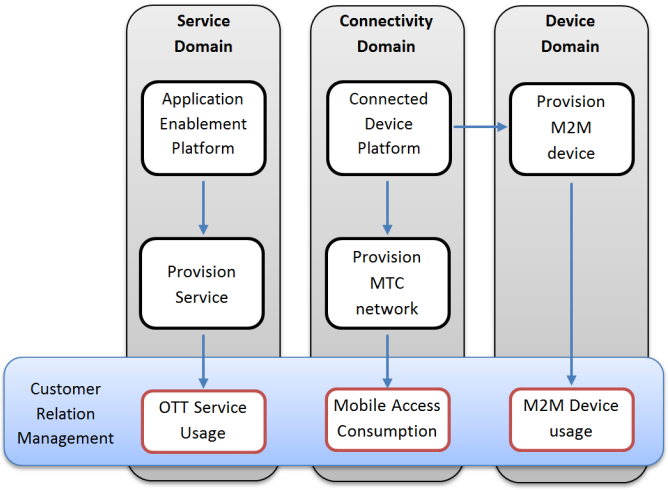

Fig. 1: Framework to study activities in M2M ecosystem [3]

and monitoring applications without human intervention [10] in order to make "smartization" possible by the aid of M2M and MTC. The so-called M2M/MTC-enabled services then are the main tools that make the cities smart. On the connectivity side, this very much sounds like the promise of Fifth Generation of mobile networks 5G.

When it comes to the demands from Wireless ICT as a provider of M2M/MTC, it is important to discuss what does the new generation of mobile networks (i.e. 5G) is promising that previous generations (e.g. 4G) did not enable? The answer is to think of 5G as of an improved generation, not only technically but mainly in Business domain; a sliced network that accommodates industry verticals and helps them horizontalize. This means that 5G is more about the demand and less about a push from technology and not only about telecommunication technology any more. Focusing more on service provisioning, and XaaS (Everything as a Service), connectivity then becomes a service enabler, while not long ago connectivity was the only service. This means that the "future telecom" is about to expand its market, more, to other industries as well as creating new market/s. Therefore, if this new market wants to happen, value needs to be created together (co-creation) with others: (a) Internally, which is among telecom actors, and (b) Externally, which is among telecom actors and actors of the other industries. The question is then how would be the relationships among firms in this new setup?

Looking into provisioning M2M-enabled services we divide M2M activities into three main domains, based on "ETSI M2M simplified architecture". These domains are Service , Connectivity, and Device (Figure 1). In each domain there are some activities that are performed by providers and one activity that is performed by the end user. All the end user activities then comprise one horizontal layer that corresponds to the Customer Relation Man-

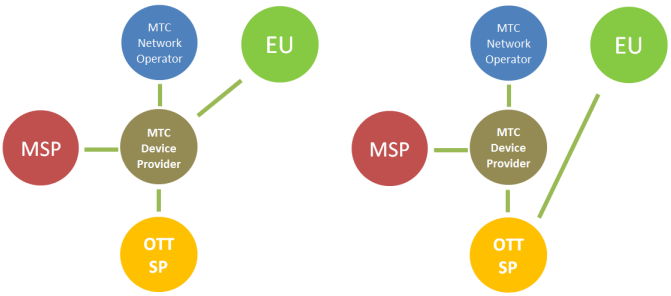

Fig. 2: Two M2M Value Network instances in Smart Cities [3]

TABLE I: Who is capable of what

	Actors		
	MNO	TEV	SP
MTC network Provisioning	X		
MTC device offering			X*
CDP provision	X	X	
AEP provision		X	X
Offer M2M-enabled service			X
End User relation management			X

*This situation happens in case SP is the industry vertical service provider.

agement (CRM) activity. The CRM activity is typically performed by the actor who is in direct connection to the end user. Therefore, figure 1 presents a framework to study M2M activities. The framework illustrates the relations among activities in terms of inter-dependencies, as well as the sequence of activities to be performed. The main idea behind implementing this formation is to present the value flow [11]. This framework will eventually facilitate the process of distributing responsibilities among actors and also helps identifying the actors and possible grouping of activities to be performed by any actor.

According to the framework (figure 1) each activity can be performed by one actor in the value network, while the end value is being co-created by the entire network. This idea is also approved by the case studies presented in [3]. The only concern is then provisioning the Application Enablement Platform (AEP) [12], where the case studies show that AEP is typically provisioned together with the service and in some few instances as a complement to the Connected Device Platform (CDP) [12]. Therefore the role of AEP provisioning is not a stand-alone role in the value network. As a result we introduce the following abstract actors:

- MTC network operator
- M2M/MTC device provider
- MSP
- OTT service provider

A major actor in this setup is then an entity which performs the role of provisioning CDP. It can be seen that this activity is mainly performed by the firms who have a background in provisioning connectivity in the sense of automating connected devices. Some examples can be either outsourcees of network operations for MNOs or the ones which have been active in automation of industry verticals (e.g. General Electric, Siemens, etc.). The so-called MSP actor is the firm that takes this role. It should be mentioned that AEP provisioning, in case of bundling as a complement to CDP, is also performed by this actor.

Eventually, we introduce two abstract M2M value network instances (Figure 2 that illustrate MTC-based mobile service provisioning. In these networks the abstraction is on the firm level that means any actor who owns the resources-competences associated to each activity can perform the activity. The major difference between these two instances is the interaction with end user. In the model on the right, the SP is the firm that interacts with the end user. This happens when the device is part of the service and the main value is delivered by the service and not the device. An example is the case of smart meters. The electricity meter is typically offered to the end user by the energy company, although the energy company is offering the device as part of the service (that is metering energy consumption).

The model on the left then presents a case where the device provider initiates the relationship with the end user by offering the device, since the device itself bears a value of its own. The device provider then maintains this relationship via offering M2M-enabled service as an add-on (e.g. M2M services offered on personal vehicles). In this case, the services over the top of this device are also being offered through the device provider to the end-user, which means without this channel there is not a possible way to offer the OTT services to the end user. The device provider holds the role of interacting with the end user, mainly because of the notion of the device (as a platform for services). This case can mainly happen when the device provider is the industry vertical solution provider itself, and is offering services of its own (the case that we formerly called it SP). For instance when an automotive company is offering a “connected car”, the car as a the M2M device is holding a high value in the service provisioning and also serves as a platform for other services to be offered on top of it. This situation is typically profitable for the device provider in case they have an ongoing relationship with the end user, which is gained via a M2M-enabled service by the device provider/SP itself.

The three actors under study –MNO, TEV, and SP– typically take different roles from the aforementioned value network based on their business models. On one hand the resources these actors possess, as well as the competence to perform the activity is a major reason that they play any specific role. On the other hand, other reasons such as where to position the firm in the value network, who to compete with, who to collaborate with, and external forces also affect the strategic decision of which role/s to

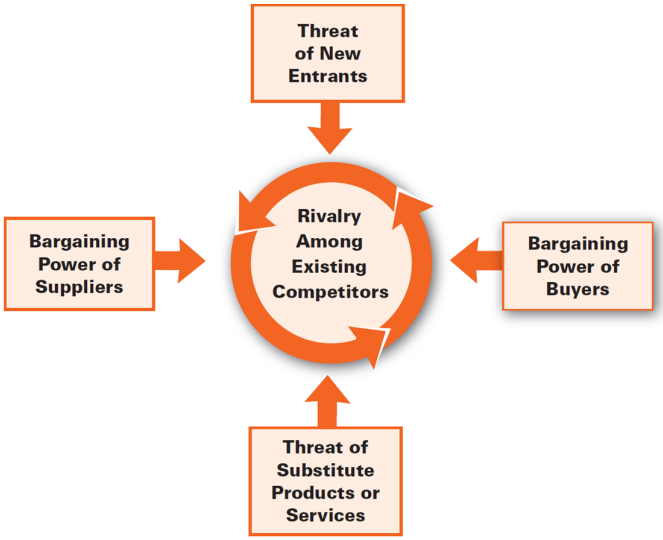

Fig. 3: The Five Forces That Shape Industry Competition [8]

take. Therefore, here we present a table illustrating what are these actors capable of, according to their traditional business and resources/competences (Table I).

IV. Business Relationships within a value network context

In this section we discuss the business relationships among different actors of the value network introduced earlier. We use Porter's five forces model as a checklist for identifying important business relationships for each group of actors under study (focal firm). As a result of this analysis we determine the positions in which MNOs, TEVs, and SPs would possibly compete with each other and/or cooperate. In order to use the P5F model, first we put the forces into the telecom industry context and discuss them in general in the context of our study.

1) Threat of New Entrants

In the old telecom value chain, as a capital-intensive industry, the biggest barrier to entry was access to finance. In the future telecom industry, where telecommunication plays the role of enabler for services, the situation is different. When services co-created by multiple actors, or services created over the top of other products bear the value, the threat of competitive entrants escalates. Not like before, ownership of a telecom license does not necessarily represent a huge barrier to entry. This is because there is probably a license holder who is willing to cooperate with the SP in order to create the value.

2) Power of Suppliers

In the context of value networks, unlike value chains, suppliers have a less critical position. At the same time there are actually large number suppliers around willing to become part of the telecom-enabled service. Vendors, arguably, are not the sole supplier of the value chain any more. MNOs, Vendors, IT companies and even Service Providers in different settings become suppliers to each other since the creation of value does not follow the same linear chain any more. As a result, the bargaining power of suppliers is diluted.

3) Power of Buyers

With introduction of variety of telecom-enabled services and demand oriented service provisioning, the bargaining power of buyers rises. Traditional telecommunication services such as connectivity have become a commodity and their availability can be taken for granted. This translates into customers seeking low prices from companies that offer reliable service. Switching costs are relatively lower for end user but higher for those in need of customized solutions, but still buyers intend to avoid lock-in and vendor lock-in effects. At the same time, due to the power of business customers who own a considerable share of end users, suppliers tend to offer tailored solutions for their customers, just not to lose the revenue.

4) Availability of Substitutes

Services from non-traditional telecom actors pose serious substitution threats over traditional products/services. Specialized actors who focus on a specific activity and target niche markets also have emerged that their services are comparatively well designed. At the same time, some traditional actors step in and perform same activities as their suppliers/buyers in another setting would offer and they can offer the same service to the end user.

5) Competitive Rivalry

Competition is fierce. New entrants, previous suppliers overtaking buyers position, previous customers overtaking suppliers position, substitute services made by similar firms, different constellations working together to create value, and more global offerings are enough reasons to worry about competition. Limiting competition to the existing rivals, similar firms and replacement by previous customers/suppliers seem to be the highest threat in terms of competition.

Now that we have a better understanding of the five forces, we introduce other possible exiting (traditional) actors that perform the presented activity list mentioned in figure 1 in order to have a complete picture of Suppliers, Customers, and Existing rivals according to P5F. We remind that, as stated before, the industry vertical solution providers are the same entities as SPs. OTT service providers are then the, typically, small businesses that just offer services over the top of the existing infrastructure/services. Besides the discussed actors –MNOs, TEVs, and SPs– the other important actors are:

1) OTT Service Providers (e.g. Spotify, Facebook, etc.)
2) CRM & billing solution providers
3) Software based systems & solutions firms (SBSS). These are typically non-wireless ICT firms (sometimes referred to as IT companies). Such firms in the

TABLE II: Five forces analysis on MNOs

	Existing rivals	Suppliers	Customers	New entrants	Subs products
MTC network provision	1. MNO 2. Capillary network operator	1. TEV 2. SBSS	1. Device provider 2. SP	Specific MTC network provider	Capillary network
MTC device offering	-	-	-	-	-
CDP provision	1. MNO 2. TEV	1. TEV 2. SBSS	1. Device provider 2. SP	Specific CDP provider	Specific CDP provider
AEP provision	-	-	-	-	-
Offer M2M -enabled service	-	-	-	-	-
CRM	-	-	-	-	-

TABLE III: Five forces analysis on TEVs

	Existing rivals	Suppliers	Customers	New entrants	Subs products
MTC network	-	-	-	-	-
MTC device offering	-	-	-	-	-
CDP provision	1. TEV 2. MNO	SBSS	1. Device provider 2. SP	Specific CDP provider	Specific CDP provider
AEP provision	1. SBSS 2. SP	SBSS -	1. SP 2. OTT SP	Specific AEP provider	n/a
Offer M2M -enabled service	-	-	-	-	-
CRM	-	-	-	-	-

TABLE IV: Five forces analysis on SPs

	Existing rivals	Suppliers	Customers	New entrants	Subs products
MTC network provision	-	-	-	-	-
MTC device offering	SP	Device provider	1. End User 2. OTT SP	n/a	n/a
CDP provision	-	-	-	-	-
AEP provision	1. SBSS 2. SP	n/a	1. Device provider 2. OTT SP	Specific AEP provider	n/a
Offer M2M -enabled service	SP	1. MNO 2. TEV 3. Device provider 4. SBSS 5. Specific AEP 6. Specific CDP	1. End User 2. Device provider 3. OTT SP	n/a	Other services
CRM	Device provider	n/a	1. End User 2. OTT SP	n/a	n/a

context of telecom industry mainly offer measurable performance improvements in an operator's business processes, with software that is scalable, configurable and that provides end-to-end capabilities. The business segment develops and delivers software-based solutions for OSS and BSS, TV and media solutions, as well as solutions and services for the emerging m-commerce ecosystem. We consider that Business Customer Support companies and Consulting and Systems Integration (CSI) companies also belong to this group.

4) Device provider, which refers to companies that manufacture the devices which will be offered to end user in this value network. This is the same device that is

enabled by MTC capabilities.

5) Specific MTC network provider:
   - Wide area wireless communication providers: e.g. Sigfox.
   - Indoor communication providers: e.g. Wi-Fi companies such as Aptilo.
6) Special CDP providers (e.g. Jasper, Sierra wireless, Wyless, etc.).
7) Special AEP provider (e.g. ThingWorx)

Now we take the three actor groups –MNOs, TEVs, and SPs– separately and put them in the P5F model. We will do this based on the case studies presented in [3], tableI, and the discussion in the beginning of section IV (on putting PF5 in the telecom context). We use the list of important actors in order to find possible existing rivals, suppliers, and customers. The results are then presented in tables II, III, and IV, which show the five competitive forces of the market for each group of focal actors.

Based on the tables, we can identify the coopetition areas among the three actor groups. As it is illustrated in the tables, on one hand in the "existing rivals" column if any of the three actors (beside the focal actor) exists that means competition. On the other hand, if any actor (besides the focal actor) exists in the Suppliers-Customers columns, that means cooperation among them. We will translate these two instances into Coopetition while both of them happen at the same time.

A. Why are customers important?

With regards to the "customers" and "suppliers" columns, we argue that the relationship among any supplier and its customer is quite important for the survival of the supplier's business. This highlights the risks associated with competing with customers. On economic terms, what is important for a firm is higher profit. Profit is a financial benefit that is realized when, in a business activity, gained-revenue is more than all expenses (including taxes). The source of the revenue gained by the firm is then the price the customer pays.

For a customer, value is defined as the ratio between the benefits they receive and the price they pay.

$$ValueforCustomer = \frac{Benefit}{Price}$$

Considering that the Value for a firm (producer) is reflected as financial profit; value is the difference between the revenues they receive and the costs they incur.

$$ValueforProducer = Revenue - Expenses$$

So more profit for the producer can be gained by:

1) Creating more benefit for customers
2) Increasing the number of customers
3) Lowering expenses

Or in other words, "Customers are the economic resource to be cultivated by the supplier". As a result it is a major concern when a supplier would like to jeopardize profit by causing discomfort in its relationship with customers by competing with them. This is important when competition comes after cooperation; when an existing cooperative business relationship (e.g. supplier-customer) is ongoing and then competition occurs.

V. Conclusion

While searching for instances of coopetition among actors of Telecom industry, an interesting finding is that convergence of wireless ICT actors and other industries for co-creating value in various industries has caused changes in Telecom value chains. We argue that linear value chains cannot support the inter-firm relationships any more. This is mainly due to the fact that value is not being created in linear chains but instead in a value networks. At the same time diversity of markets that ICT is involved, simply creates a situation where Telecom actors do not necessarily follow any "Telecom-specific" pattern any more. As a result Telecom actors try to adapt to their Business customer's preference in their business to business (B2B) transactions, and customers' respective market structure. This mix causes a web (complex) of relationships; instead of linear chains or simple networks. Eventually Value Networks, in contrary to Value chains, seem to be applicable to all industries that deliver services instead of goods to end users.

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