

# Coopetitive Business Models in Future Mobile Broadband with Licensed Shared Access (LSA)

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## Abstract

Spectrum scarcity forces mobile network operators (MNOs) providing mobile broadband services to develop new business models that address spectrum sharing. It engages MNOs into coopetitive relationship with incumbents. Licensed Shared Access (LSA) concept complements traditional licensing and helps MNOs to access new spectrum bands on a shared basis. This paper discusses spectrum sharing with LSA from business perspective. It describes how coopetition and business model are linked conceptually, and identifies the influence of coopetition on future business models in LSA. We develop business models for dominant and challenger MNOs in traditional licensing and future with LSA. The results indicate that coopetition and business model concepts are linked via value co-creation and value co-capture. LSA offers different business opportunities to dominant and challenger MNOs. Offering, value proposition, customer segments and differentiation in business models become critical in mobile broadband.

**Keywords:** business model, coopetition, futures research, mobile broadband, mobile network operator, spectrum sharing, licensed shared access.

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## 1. Introduction

Mobile broadband is growing at a rapid pace [1], placing increasing demands on the already scarce spectrum resources, especially in urban areas. This spectrum scarcity puts the mobile network operators (MNOs) providing mobile broadband services in a new situation and against a disruptive change, as regulators are considering spectrum sharing in the future due to difficulties in finding exclusive spectrum [2]. Thus, MNOs are facing the need to change the value creation and capture logic of their business models toward coopetition, as simultaneous competition and cooperation in the form of utilizing shared spectrum becomes the reality. However, neither coopetition nor business model literature provide a clear explanation on

how business model and coopetition concepts relate to each other, thus impeding the process of business model change in the emerging coopetitive business environment.

The growing traffic demand has motivated the search for new spectrum access methods that could allow the deployment of mobile communication networks in new spectrum bands on a shared basis with incumbent wireless systems. Licensed Shared Access (LSA) concept has attained particular interest in Europe as a means for allowing MNOs to access new bands that are currently used by other types of systems. Practically LSA means that incumbent spectrum users' excess spectrum is licensed to MNOs for offering mobile broadband with the agreement of giving it back when the incumbent users need it. Mobile broadband offers Internet connectivity to mobile devices using the wireless medium – the radio spectrum. As the demand for the mobile broadband is constantly increasing,

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there is pressure for MNOs to get access to more spectrum. Similarly, different types of wireless services are competing over the access to the radio spectrum. To ensure spectrum availability for the mobile broadband in the future, spectrum sharing is emerging by allowing different wireless systems to use the same spectrum band leading to improved efficiency of spectrum use.

The extant literature on business models abounds with various understandings of the concept – an architecture [3][4], a recipe [5][6], a narrative [7][8], a cognitive map [9], a design [10] or actualization of decisions and actions [11]. However, it lacks a dominant conceptualization suitable for research and practice [12]. In this study the authors argue that a business opportunity is the nexus of a business model and view a business model as an action centered around a business opportunity [11][13].

Building on an extensive literature study, Zott et al. [12] proved that a business model concept can be seen as a systemic and boundary spanning unit of analysis explaining how companies create and capture value. Indeed, a business model can act as a pathway to competitive advantage built upon a business opportunity [4][14][12]. However, in the emerging highly competitive, dynamic and complex business world traditional approaches towards creating competitive advantage proved to be ineffective forcing companies to search for the novel ways of value creation and value capture to sustain firm performance. Ray Noorda, founder and CEO of Novell, was the first to realize the benefits of alliances between technology competitors and to introduce a co-competition strategy as an innovative way for market expansion.

Similarly to the business model phenomenon, the concept of co-competition has raised much discussion generating a range of approaches but leaving the phenomenon unclear. However, the basic idea behind co-competition boils down to the simultaneous co-existence of cooperative and competitive relationships between actors. On the business model level, cooperation generally takes place in the value creation process, whereas competition - in the value capture process. Therefore, co-competition context implies that the actors are jointly and simultaneously involved in value creation and value capture, in other words, they co-create and co-capture value. Thus, viewing value co-creation and value co-capture as boundary spanning activities allows for linking between business models and co-competition contexts [15][16], and highlighting the role of co-competition in “doing” business” with business models, as Teece [4] pointed out.

Building on the business model and co-competition literatures, this paper seeks to explore the emerging co-competitive business models of the MNOs in the context of the new Licensed Shared Access (LSA) concept for mobile broadband. The new LSA concept opens up a unique setting for exploring and researching future co-competitive business models of the MNOs facing a disruptive change in their business. The key research questions of the paper are thus as follows:

- (i) How co-competition and business model are linked to each other conceptually?
- (ii) How co-competition may influence future emerging business models in spectrum sharing?

The rest of this paper is organized as follows. It starts by introducing the LSA concept as the research context. The paper proceeds by developing the theoretical framework of co-competitive business models consisting of the theories of co-competition and business models. Next, the research methodology explains the process how future business opportunities and corresponding business models are arrived at. Then, data analysis including the analysis of spectrum sharing for mobile broadband with LSA using the co-competitive framework is presented. Finally, the discussion and conclusions section presents the empirical and theoretical contribution of the research.

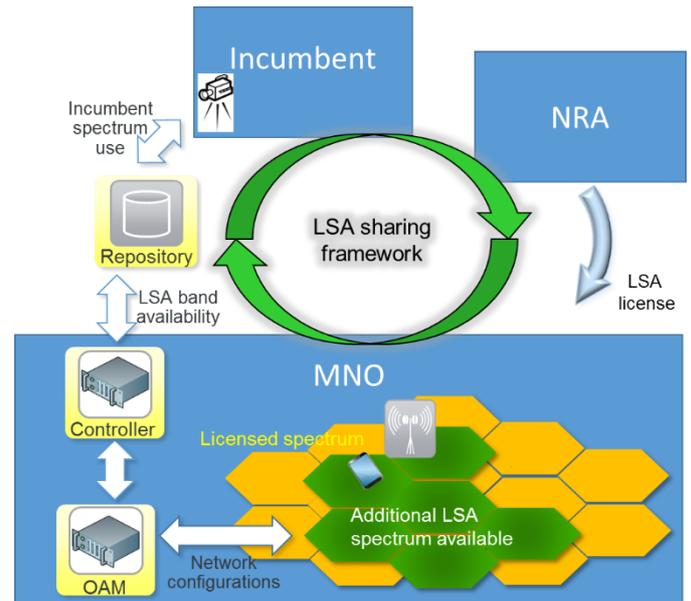
## 2. Licensed Shared Access (LSA)

Until now spectrum access for MNOs has been based solely on exclusive licenses with long license durations and wide coverage areas. However, increasing challenges in finding spectrum resources that are available or realistically could be freed from existing usage have inspired more flexible ways to assign spectrum resources to the MNOs. Spectrum sharing allows two or more radio systems to operate on the same frequency band under certain rules and conditions that provide a feasible operational environment for the systems.

Licensed Shared Access (LSA) concept has recently been introduced in European regulation and standardization as a complementary approach to the traditional spectrum access approaches to make new spectrum available for the mobile broadband on a shared basis. The Radio Spectrum Policy Group (RSPG) of the European Commission (EC) has defined LSA in [17] as “*a regulatory approach aiming to facilitate the introduction of radio communication systems operated by a limited number of licensees under an individual licensing regime in a frequency band already assigned or expected to be assigned to one or more incumbent users. Under the LSA approach, the additional users are authorized to use the spectrum (or part of the spectrum) in accordance with sharing rules included in their rights of use of spectrum, thereby allowing all the authorized users, including incumbents, to provide a certain Quality of Service (QoS).*” In other words, the LSA concept aims at allowing new licensed users, for example mobile network operators (MNOs), on spectrum bands that already encompass other type of incumbent use. The LSA regulatory and standardization efforts have first focused on the 2.3-2.4 GHz band with MNOs being the LSA licensees and incumbents varying depending on the national situation (e.g. wireless cameras and military incumbents) and in 3.6-3.8 GHz band (e.g. fixed satellite service and fixed service incumbents).

The key stakeholders in the LSA concept include a national regulatory authority (NRA), an incumbent spectrum user, and an LSA licensee who together define the sharing framework and agree on the rules and conditions for sharing [18]. Figure 1 illustrates the LSA concept. The LSA concept allows sharing between the incumbent spectrum users and the LSA licensee with conditions that guarantee the rights of both entities. Sharing is based on the LSA license issued by the NRA and the agreed sharing framework. The LSA concept offers exclusive individual access rights to a portion of spectrum at a given location and time to both the incumbent and the licensee thus guaranteeing required quality of service (QoS). The incumbent maintains higher usage rights and may reclaim the spectrum band or parts of it in a certain area. The LSA concept is attractive for MNOs that could use it to gain access to new spectrum bands to meet the growing data traffic demands of their customers. The LSA concept is based on voluntariness or it could be requested by the regulator. This is why the concept has to offer clear benefits to all its stakeholders to be implemented in reality. While LSA is a national matter decided by the NRA, a harmonized LSA sharing framework is seen to be beneficial to develop a European harmonized approach and market.

The MNO needs to be able to respond to the varying availability of the LSA spectrum due to incumbent activity in the band. The LSA implementation is foreseen to be based on two additional functional units on top of the existing mobile network architecture including LSA Controller and LSA Repository as shown in Figure 1. In its simplest form, LSA does not require modifications to the existing mobile networks or user equipment beyond implementing the support of any new frequency band. The LSA Repository stores and updates the information about the availability and use of LSA spectrum band together with the prevailing policies and conditions. The LSA Repository also coordinates the information exchange between incumbent users and LSA Controllers. The LSA Controller ensures the protection and interference-free operation of the incumbent user and mobile network, by calculating the protection areas based on the information received from the LSA Repository and the information on the mobile network layout, used transmission powers, and so on.



**Figure 1.** LSA concept, key stakeholders and building blocks.

### 3. Coopetitive business models

#### 3.1. Competition

##### Why do we need competition?

The emergence of competition concept in the IT field emphasizes its importance for the high technology industries that seem to face unique challenges and opportunities, and therefore are more predisposed to the new innovation strategies [16]. Gnyawali and Park [19] argue that three major technological challenges – shorter product life cycles, convergence of multiple technologies, and increasing R&D and capital expenditures – serve as important drivers for firms in high technology industries to engage in competition. Owing to the substantially shrinking product life cycles, firms are constantly searching for the new ways to speed-up their innovation efforts [20]. Technological convergence increases risks and uncertainty about the market and technology and compels the firms to look for the other firms, including competitors, to share the risk and to access and combine a variety of sophisticated technologies. Finally, R&D and capital expenditures tend to be substantial in high technology sectors. Such costs provide strong incentives for companies to cooperate with competitors that have a large resource base [16]. According to Bengtsson and Kock [15], when the need for external resources is high and a firm's position in the industry is strong, it is more likely to cooperate with competitors, thereby adopting competition strategy.

At the firm level, three factors motivate competitors to collaborate: standardization, a possibility to learn more

about their rivals' competences, and an opportunity to solve problems outside the realm of competition by influencing the nature of regulatory environment [21]. Industry level and firm level factors are connected through technological convergence which provides opportunities to set industry standards and to shape industry structures [16].

To be able to cope with the challenges posed by new technologies and to sustain competitive advantage, there is a need to rethink the traditional ways of value creation and innovation. In the words of Johannessen and Olsen [22], the firms "need to change the recipes for success". Facilitating the increase of technological diversity and assisting in combining complementary resources of rival firms in developing new technologies and products, co-competition provides an effective way to compete in a new economic landscape.

### What is co-competition?

The basic idea behind co-competition is the simultaneous coexistence of cooperative and competitive relationships between actors. As co-competition has become an integral part of many companies' daily agenda, the research interest towards the phenomenon has increased rapidly inducing a new research paradigm [16][23]. Inter-firm interdependences have traditionally been viewed through the lenses of two opposite perspectives – either competitive or cooperative. Competition promotes a self-interest-oriented behavior since any action bound to accumulate profits provides benefits for one firm at the expense of the others [24]. In the words of Vickers [25], competition is a process wherein "two or more firms strive for something that all cannot obtain."

While competition can be regarded as a negative- or zero-sum game, cooperation implies a positive-sum game where the performance of the cooperating firms is mutually dependent. Utilizing game theory, Brandenburger and Nalebuff [26] emphasized the limitations of both paradigms as accounting only for part of the reality, and suggested combining competition and cooperation via co-competition. The authors analyzed co-competition from the perspective of relationships in a value-network of customers, suppliers, complementors, and competitors that jointly added value to a focal firm [27]. Studies in this vein perceive co-competition as a win-win relationship and focus on balancing value creation and value appropriation [28], i.e., value capture. The shift in the business environment has triggered also the use of other approaches to study co-competition. For instance, scholars in the resource-based view argue for the importance of mutual development and utilization of technologies and resources [29][30], whereas researchers favoring the network approach emphasize the importance of cooperative relationships between competing firms [23].

Yet, despite more than 20 years of research and a range of approaches, the definition of the concept itself remains unclear, blurring the research field [31]. Frequently, the concept is defined so as to suit specific research purposes. According to Bengtsson, Eriksson and Wincent [27], there are two main understandings of co-competition: co-competition as

a context and co-competition as a process. Contextual approach stems from the seminal work by Brandenburger and Nalebuff [26] and suggests a broad understanding of the co-competition phenomenon as a value-net of relationships between various actors. In this view two competitors can cooperate with each other to better compete with the third firm [32]. However, as Bengtsson and Kock [15] have noticed, it gives rise to a co-competitive situation, not a competitive interaction.

Narrow process approach focuses on the interplay of cooperation and competition between two directly competing companies. From this perspective, co-competition can be looked upon as either a continuum ranging from strong competition to strong cooperation, i.e. the intensification of one of the processes happens at the expense of the other, or as a multidimensional or two-continuum concept describing the coexistence of both processes. Therefore, co-competition can assume a number of different values [23][24]. The two-continuum approach suggests that cooperation and competition are two different interactions proceeding in parallel within a co-competitive relationship [27][32].

However, research in the contextual and process streams tends to focus on the relationship only between two specific companies. Yet, the contemporary business environment has become more dynamic, convergent, changeable, and frequently several firms can be simultaneously involved in cooperation and competition with each other. Therefore, following Bengtsson and Kock [23], for the purposes of this research co-competition is defined as a "relationship between multiple actors simultaneously involved in cooperative and competitive relationships, regardless of whether their relationship is horizontal or vertical". This definition not only reflects the changes in the business environment but also allows accounting for the process and context features of co-competition and overcoming the dyad bias. Besides, according to Bengtsson and Kock [23], by focusing on the activities performed and the various roles played by the actors, this interpretation of co-competition better suits the analytical purposes.

## 3.2. Business models

### Why do we need business models?

As noted by several researchers (see e.g., [33][4]), value creation and capture play a crucial role for business models. The concept has in general been seen to show promise due to its simplicity, compactness, and easy visualization, and when these features can be extended to understand the value creation and capture logic of the firm, we can identify several benefits. Based on Morris' et al. [34] contribution to the functions of business models, five main applications can be identified in this respect. To start with, a business model is a communication means, a mapping for operations. Prior to its operation it can be used as an *ex ante* representation of the business model and its possible outcomes and as a device to articulate a firm's value proposition also to outsiders such as partners [5].

Second, a business model helps to identify key-variables that are to be uniquely combined to reach competitive advantages. Third, a business model demonstrates the economic attractiveness of a venture or business [5] or, as Chesbrough and Rosenbloom [35] formulated it, as an estimation of cost and profit structures of the business.

Fourth, a business model constitutes a guide for an organization's ongoing operations. Apart from a business operational tool, the business model depicts the sequence of events to be implemented [5]. The sequence includes also activities going beyond firm's boundaries. Therefore, Chesbrough and Rosenbloom [35] suggested using business models to define a company's value chain structure and its position within the value network.

Finally, the business model can be used as a means to identify necessary modifications to a business as a result of changing conditions. Baden-Fuller and Morgan [5] mentioned that companies may run several parallel business models simultaneously. These "portfolio business models" articulate different activities that are based on the same resources or competencies. A business model portfolio facilitates the combination of internal activities and external demands by fostering the extension of existing core competencies to enlarge existing target markets/groups and their redeployment to serve new markets [6].

### Coopetition and business models

The extant literature on coopetition is still short on clearly explaining the link between coopetition and business models [23]. Zott et al. [12] argued that the business model can be considered as a new unit of analysis spanning both the firm and network levels of analysis and it can enhance holistic understanding of business dynamics. This can be seen as the theoretical starting point for combining business model and coopetition literatures.

Initially the term coopetition was affirmed and rooted in strategy literature; therefore, many of the prior studies have conceptualized coopetition as a strategy especially relevant for creating innovations in a highly competitive environment [36]. A similar kind of discussion can be seen in the business model literature between the business model and strategy, as the business model has been seen as the practical implementation of the abstract strategy [37]. The current theoretical and empirical research on innovation-related coopetition strategy suggests that it is suitable for creating incremental improvements in current products and services, and it is also an effective way for generating radical innovations in certain sectors, for instance in high-tech industries [38]. Another approach suggests that coopetition is a new business model in itself aimed at improving firm's performance and increasing collaboration with other business actors [39].

How, then, should we define the business models in a coopetitive context? Osterwalder et al. [40] defined the business model as consisting of nine elements: Value proposition, Customer segments, Channels, Customer relationships, Key activities, Key resources, Key partners,

Cost structure and Revenue streams. But, business model has also been referred to as comprising such elements as Strategic choices, Value network, Value creation, Value capture [33]; Value proposition, Value creation and Delivery system, and Value capture [37]. Paving the way to a coopetitive definition, Onetti et al. [41] defined business model as to consist of the elements focus (what?), modus (how?), and locus (where?). Value creation can thus be viewed as a boundary-spanning [12] process where value is co-created among various actors within a network as a joint effort, and together with the customers [42]. In addition to value co-creation, an equally important aspect of value is the ability to capture value, i.e., to obtain profits, which in the networked or cooperative context can be called value co-capture. Coopetition, in turn, illustrates the increased complexity of the business environment where companies simultaneously compete and cooperate with each other.

### 3.3. Framework for coopetitive business models

On one hand, the business model concept can be regarded as a vehicle that closes the gap between abstract thinking and practice [4][37]. According to Ardichvili et al. [43], business opportunities are made to create and deliver value for stakeholders, and a business model is a result of business opportunity maturation through experimentation. In other words, realizing an opportunity implies designing and implementing a business model [8]. Thus, business opportunity can be seen as the heart of a business model. According to Zott and Amit [44], one of the functions of the business models is to exploit this opportunity. On the other hand, however, opportunities themselves lack agency, therefore a decision by a person to act upon an opportunity is required [45]. Therefore, a business model can be understood as action centered around a business opportunity [11][13]. If a firm is to establish a competitive advantage based upon an opportunity, its business model has to be differentiated, effective, and efficient. Furthermore, the elements of the business model have to work as a system [4] that extends beyond organizational boundaries and also involves exchange partners of the focal firm [44][46].

If we see the business model as a concept as built around a business opportunity [4][12], it can be seen to help to answer the questions what companies are offering to their customers in terms of products/services and value proposition, how, where and with whom they are planning to do that in practice and why they think they can do it profitably. Key elements of this business model concept, built around the business opportunity, include the following:

- (iii) When? Related to the timing of and factors contributing to the business opportunity
- (iv) What? Offering, value proposition, customer segments, and differentiation

- (v) How? Key operations, basis of advantage, mode of delivery, selling and marketing
- (vi) Why? Base of pricing, way of charging, cost elements, and cost drivers
- (vii) Where? Location of activities/items, internally or externally of the company

The location of or perspective to the items (internal or external) presented concerns the items 1-4 in the preceding list. The processes of value co-creation, co-capture, and co-competition can be seen to give the frames for the business model conceptualization.

To summarize, although closely linked, the concepts of co-competition and business model cannot be equated since the former belongs to the strategic level, whereas the latter to the functional level or the level of actions. Analyzing a business model not only from the focal firm perspective but also as a larger construct incorporating the collaborating architecture of the firm makes the concept especially suitable for the purpose of examining the rationale of co-competition [47]. More specifically, the “what” and “how” parts of the above business model definition refer to the value co-creation and value co-capture processes. Knowledge of the logic of value creation and value capture is required when developing an understanding of how a firm can benefit and gain competitive advantage from co-competition [38]. Therefore, the business model perspective is helpful in analyzing how an individual organization can affect the mechanisms of value co-creation and co-capture in a co-competition context for the achievement of the competitive advantage [47]. Thus, essentially, co-competition and business model concepts are linked through the processes of value co-creation and co-capture.

Examples of co-competition strategies leading to achievement of various co-competition-related advantages, for instance risk and cost sharing, are abundant in the contemporary business environment: Sony and Samsung in LCD-TV markets, Nokia, Siemens and Sony-Eriksson in the mobile phone industry, the Open Handset Alliance, to name just a few. Linking co-competition and business model concepts through value co-creation and co-capture processes allows examining the mechanisms leading to these co-competition-related advantages, thereby enabling the firms to realize potential co-competition advantages over time as a part of an individual firm’s business model [47].

## 4. Methodology

As this research focuses on the future co-competitive business models of the MNOs, the authors have adopted the anticipatory action research/learning method that combines action research, action learning, and foresight for helping to research future co-competitive business models of MNOs [48][49]. Action research is a future-oriented form of inquiry, concerned with development of practice by bringing together action and reflection, theory and practice in the pursuit of positive individual, as well as community

transformation [50][51]. In turn, action learning links human development in work organizations with actions on challenging issues that serve as a vehicle for learning [52]. Foresight refers to the capacity to think systematically about the future [53]. Therefore, the anticipatory action research/learning method represents a unique style of questioning the future with the intent to transform organizations and society.

This research approach builds around an interactive, collaborative process that relies strongly on conversation among and empowerment of a variety of participants, from multiple perspectives, involved in the research project. Conversation allows meaning from a range of different worldviews to be shared and negotiated for studying, theorizing, and otherwise engaging the future for helping to create it [54].

Future orientation of this method implies that positivistic criteria of reliability and validity cannot be applied as the measures for the research quality evaluation. Instead, probability and plausibility of the results ensure the research rigor. Also, the collaborative and conversation based method for creating the futures can be regarded as way to ensure the quality of the research. Additionally, we analyzed future through several parallel timeframes covering past, present and alternative futures and utilized Wilber’s four quadrant model within the business model concept to ensure the quality of the research [48][49][55].

The business models presented in this paper were created employing the co-competitive business model concept as a tool to clearly reveal their co-competitive nature. They were modelled in a series of future-oriented workshops organized by the Finnish CORE+ research project in September 2013-April 2014.

The research process consisted of four phases. First was to map the past, present and future business models of MNOs through the futures triangle [49]. The futures triangle describes today’s views of the future through three perspectives: weight of the past, push of the present and pull of the future. Plausible images of the future pull us forward; contemporary trends influence the images of the future and represent push of the present; and various hindrances to change inherited from the past weight us down. An image of the plausible future is developed by analyzing the interactions between these three forces [56]. Second phase was about anticipating the future by using the business model framework for identifying the emerging issues for analysis. Third step was to lengthen / deepen the futures by applying parallel future timeframes and four quadrant method within the business model framework to explore the strategic and systemic elements of the created business models [57]. Fourth phase was to discuss alternatives and to transform the futures by back-casting it against the past and present experience and knowledge of the participants of the research.

## 5. Data and data analysis

In this chapter we discuss current/traditional and future business models for dominant and challenger MNOs using the LSA concept. The data is collected from a series of future-oriented workshops and summarized in Figure 2. The same data was used earlier in [58]. Before the MNO business model discussion, however, we explore incumbent spectrum users' role in the LSA as the coopetitive relationship is expected to be emerging between the incumbent and the MNO within LSA. The LSA cases considered here are limited to the situation where only one MNO is using the LSA band at a time in the specific area. This restricts the coopetition aspects between MNOs. However, the LSA in general is not restricted to this situation and the resulting coopetition aspects could be expanded accordingly. The key prerequisite for the LSA concept to work is the spectrum provided by the incumbent; there is no opportunity for others in LSA without the LSA spectrum. Moreover, these LSA spectrum opportunities must be good enough to make investments feasible and profitable. The dominating MNOs are assumed to own exclusive spectrum licenses for large portions of the spectrum for mobile systems, while the challenger MNOs have licenses only for restricted amount of exclusive spectrum or none at all, such as mobile virtual network operators (MVNO). Dominating and challenger MNOs are expected to face different opportunities and challenges in spectrum sharing, and thus their business models are analyzed separately.

### 5.1. Incumbents' traditional and future business

The starting point for the developed business models is the incumbent spectrum users' excess spectrum, but the business models of incumbents remain unexplored by research, and it is not our intention to focus on them in this paper, either. Traditionally incumbent spectrum users comprise both governmental (such as military or public service providers) and commercial (e.g., companies providing programme making and special events (PMSE) services) incumbents that share a common feature of having been granted the right to use the spectrum for their specific purpose. While in the past, there has been abundance of spectrum available for the services, the incumbents previously did not face the need to optimize their spectrum use. This has led to inefficient use of spectrum and as the demand for new spectrum for mobile communications has increased, the pressure to take the spectrum away from them has increased accordingly. One of the expected strategies is that incumbents could/will be willing to share the spectrum with secondary users in order to avoid the situation where they would lose the spectrum.

Ahokangas et al. [59] argue that incumbents' business foci could comprise either an aggressive approach where the aim is to generate new revenue from new business

opportunities, or a defensive approach where the aim is to increase cost efficiency within existing businesses. The mode of change they are facing could be considered either as an interactive open mode or as a control-oriented closed mode.

The future business opportunities of the incumbents can be seen to depend on time-frames as regulators could change their business opportunities by changing the regulatory framework, namely by allowing incumbents' to expand their business to those of the MNOs. However, at the same time there exists a strong dependence, on one hand, on the degree of strictness of the licensing rules what is possible for them and what is not, and on the other hand, on the amount of shared spectrum related to total available spectrum. However, there might be an opportunity, depending on the national conditions, for the incumbents to get a monetary compensation for the first time ever which requires a change in the thinking regarding spectrum: whether it is a cost -or a source of revenue. For incumbents, entering LSA agreements can be a possibility to avoid re-farming which is a situation that a spectrum band is re-allocated and cleared from its current use to a different use. As a concept, LSA fixes or establishes the collaboration between an incumbent and an MNO. The case that incumbent's and MNO's customer groups, offering, value proposition and differentiation are completely different can be seen as an enabler for the sharing to emerge.

### 5.2 Traditional and future business models of MNOs

#### Dominant MNOs – Traditional business model

Conventionally dominating MNOs aspire to sustain their market position by acting as a "bit pipe", i.e. providing access to the mobile broadband, or as a "smart pipe", i.e. ensuring access and service availability. Dominating MNOs offer mobile broadband services that guarantee mobility, high data rates and voice, message and data services targeted for individual and corporate customers. Customers are locked-in either through the end user device, the subscription price or subscriptions' bundling for several end-user gadgets under the same contract. Customer ownership and invoicing constitute the key operations of the dominant MNOs that are frequently controlled by the MNOs themselves. Their competitive advantage is based on own infrastructure and exclusive long-term spectrum license that not only function as a barrier against new MNO entrants but also ensure service quality for the end-users and operational certainty needed for the extensive infrastructure investments. The services are marketed and sold either directly through MNO's own shops actively utilizing the customer data available in their wide customer bases or through distributors. Service pricing is fixed or usage-based and is charged as regular subscription fees. The cost drivers include infrastructure, implementation and operational expenditures, as well as spectrum license costs.

### Challenger MNOs – Traditional business model

Owing to the restricted spectrum, limited customer, infrastructure and resource base, the challenger MNOs focus on specific customers and/or services offering tailored products to selected customer segments. To differentiate from the dominating MNOs, the challenger MNOs strive for differentiation in terms of e.g. better quality, service bundle, and/or lower prices, utilizing enhanced technology for mobile broadband connection and aim for pricing the local calls cheaper via a regional license. The key operations of challenger MNOs critical for customer attraction include marketing and brand management. Intensive competition and limited markets compel the challenger MNOs to employ active market strategies for customer attraction. Tailored service design leads to extensive customer experience forming a key challenger MNO advantage. Service sales, delivery and pricing strategies resemble the ones of the dominating MNO. The main cost elements comprise operational, infrastructure and implementation ones where operational costs may be bigger than the infrastructure costs. Should the challenger MNOs be obliged to cover license costs or infrastructure rent costs (and indirectly also spectrum costs), spectrum license costs occur as in the case of virtual operators. It should be noted that our challenger MNO role also encompasses MVNOs who do not own their infrastructure or spectrum licenses but rent the required capacity from MNOs. Their traditional business model is to offer low-cost connectivity to customers.

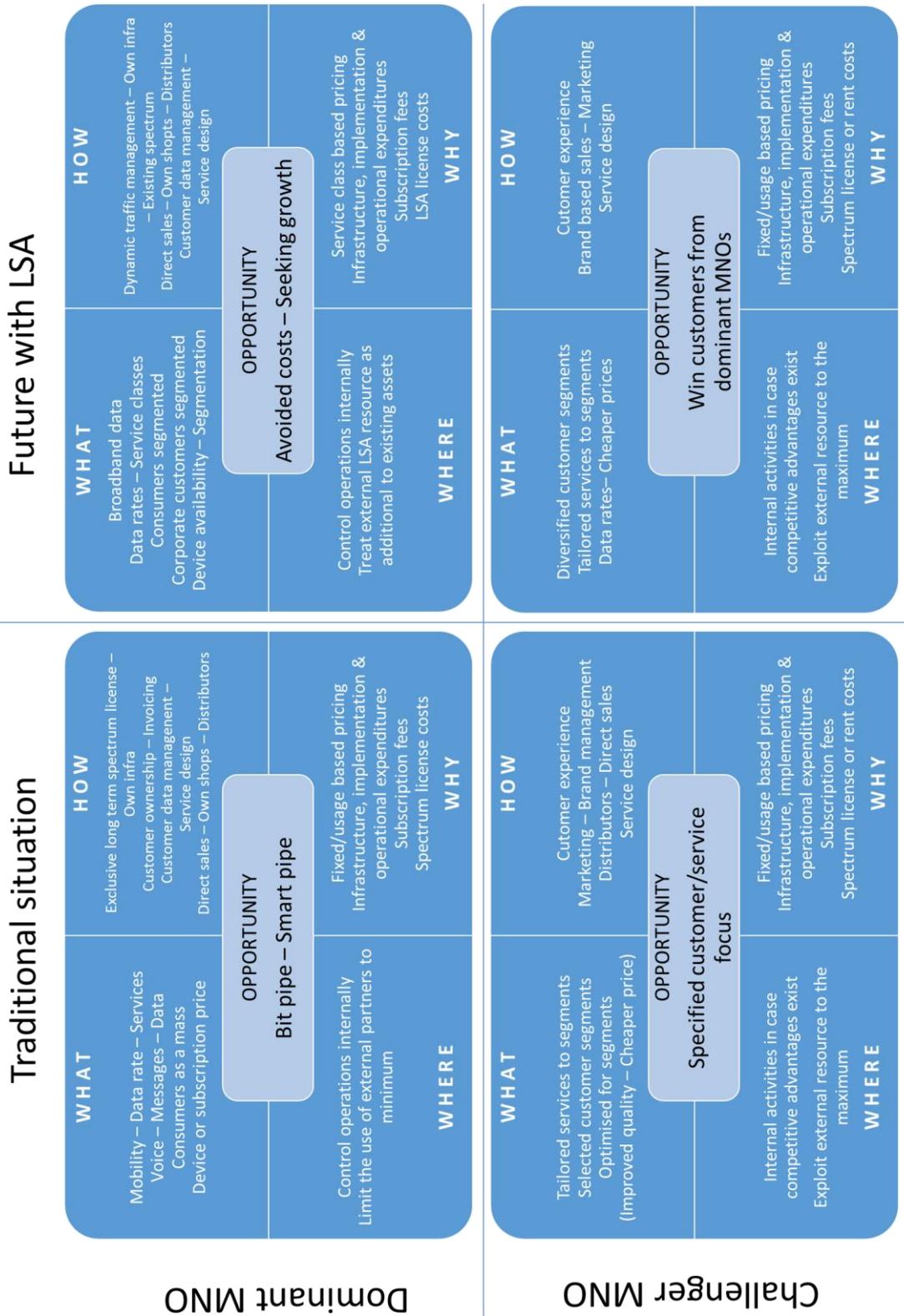
### Dominant MNOs – Future LSA business model

LSA provides the dominating MNO with an opportunity to avoid (especially infrastructure) costs and to grow under increasing mobile data traffic demand, as well as to gain access to new spectrum in areas with high demand instead of expensive compressing of the existing networks. LSA can be an easy source of additional spectrum provided that there are enough potential users. The offering can be differentiated by enhanced data rates and new service levels provision targeted for different customer segments. New service levels can be offered employing the dynamic traffic management which is possible by exploiting MNO's existing infrastructure and spectrum bands, as well as the new LSA bands. The customer data will be an important input in the service levels design. Combination of the existing and new resources might enable traffic steering between different radio access technologies, cells, and spectrum bands offering improved quality of experience to segmented customers. LSA bands-based mobility may only be restricted in the future by the local differences in the LSA spectrum availability. The new LSA bands can be used for balancing the capacity demand and service supply. In the future it will be critical to ensure the availability of mobile devices supporting the new LSA bands. The distribution channels remain the same as in the traditional business models. The service level differentiation could lead to the new service level based pricing models by charging subscription fees. The cost drivers remain the same as in the traditional business model. However,

spectrum license costs resulting from the LSA licenses may differ from those of today's auctions. In fact, the license costs of the LSA bands could be lower due to restricting conditions of the band usage, but at the same time they could be free from e.g. coverage obligations. Indeed, in certain situations, LSA increases competitive advantage of MNOs using LSA compared to MNOs without it.

### Challenger MNOs – Future LSA business model

Under the condition of enough potential users, the LSA spectrum will be attractive for any challenger MNO unwilling to participate in spectrum auctions and possessing limited spectrum in order to compete against dominating MNOs. LSA is currently planned for bands where the mobile technology already exists and thus makes it economically accessible. In particular, it could provide the MVNOs a natural path to become MNOs by using their existing customer and billing systems to expand their operations from merely renting the required infrastructure through obtaining an LSA authorization and deploying own infrastructure. The new LSA bands could also open the mobile broadband market to new other-than-MNO entrants currently not owing exclusive spectrum licenses. Therefore, the definition of challenger MNO in the LSA situation also includes alternative type of operators aiming to expand their current business onto the mobile market. In the future the access to the LSA spectrum could allow the challenger MNOs winning the customers from the dominating MNOs. The offering remains the same. Access to the LSA spectrum could partially relieve the challengers' resource limitations by enabling them to offer tailored services for even more diversified customer segments, for instance, large rural populations, machine-to-machine (M2M) and Internet of things (IoT) markets, and markets for pure data access. The key operations of challengers might include in the future brand-based sales and marketing for new customer attraction. Customer experience achieved through the service design can form the advantage base. Social media is seen as a potential complementing distribution channel. The main cost drivers and ways of pricing are expected to be the same. However, the challenger will need to acquire the necessary infrastructure and sites to operate on the new spectrum bands. Should the challenger not possess own infrastructure at all, it will be difficult and very costly to acquire required site density to cover wider geographical areas. Also, the LSA license costs will play a role but they could be lower than auction prices paid for exclusive licenses.



**Figure 2.** Business models for dominant MNO and challenger MNO is traditional situation and envisaged future with LSA.

## 6. Discussion

The above data and analysis gives rise to a variety of empirical and theoretical conclusions and contributions. As the key questions this paper was set to explore were “*How cooptition and business model are linked to each other conceptually?*” and “*How cooptition may influence future emerging business models in spectrum sharing?*” In the following we will discuss the contributions and limitations of this research.

### 6.1. Contribution of the research

The findings of this research regarding the reasons for cooptition seem to accompany that of Gnyawali and Park’s [19] that cooptition is induced by technology convergence and increasing investments needs. At the same time, while Bengtsson and Kock [15] argued that a high need for external resources by firms with strong industry position induces cooptition, we find that high need for external resources in the context of cooptition may lead to increased competitive advantages, however, only for the stronger players in the industry. Especially, the difference between a challenger and a dominant MNO can be easily seen in the cooptitive environment, as direct cooptitive strategies can be identified between the MNOs and incumbents. However, we do not specifically discuss the business models of the dominant MNO and challenger MNO in this paper since the main focus is on the cooptitive relationship between an incumbent and an MNO (dominant or challenger) in LSA where they share the same spectrum. Brandenburger and Nalebuff [26] and Bengtsson, Eriksson and Wincent [27] discussed cooptitive behavior within a value network. However, we identify that cooptitive behavior can appear between firms the value networks of which are not, or are only partially, connected. Also, our research findings are in line with the definition of cooptition given by Bengtsson and Kock [23].

The idea that business models are built to exploit a business opportunity [44] leads one to think that cooptition serves a dual role regarding business models. First, cooptition *ex ante* expands the range of the emerging business opportunities and second, as a consequence it may influence all the key elements of the business model. As far as the influence of cooptition on business models is concerned, cooptition favoring context where the stakeholders see a common, related, or synergistic opportunity field can be regarded as a precondition for the emergence of cooptitive business models. Boundary-spanning activities [12] of value co-creation and value co-capture increase the dependencies between the business models in cooptitive context. Furthermore, the “what”-part of the business model is becoming of critical importance in the context of mobile broadband.

Following Teece [4] who stated that business model associate value creation and capture, we expand this

conceptualization to include value co-creation and value co-capture. In other words, we argue that business models associate value co-creation and co-capture. Based on our theoretical framework and empirical results, cooptition and business models concepts are linked via boundary-spanning [12] activities, constituting the basic logic of value cooptition. And, the five questions of the cooptitive business model concept we discussed in chapter 3 allow revealing the value cooptition behavior.

To conclude, we see that when discussing cooptitive business models, the concept of cooptition should not be exclusively related to the strategic level. In other words, we face the same problem that has been encountered in the discussion between strategy and business models where business model has been seen as a practical implementation of the more abstract-level strategy. Maybe we should start to discuss cooptition as relating also to a practical implementation of strategy, i.e., assume the strategy-as-practice approach.

### 6.2. Limitations and quality of the research

There are several limitations in the current study. First, due to the nature of the LSA concept, true cooptition was observed only between incumbents and MNOs as the concept does not allow investigating the relationship between an incumbent and several MNOs. Second, the futures research methodology requires analyzing the data and building business models based on three criteria – probability that is based on looking at business trends; plausibility that is based on events that could be seen to take place in the future; and preferability that is based on choices of the research process participants regarding the business models. Since there cannot be facts about the future, drawing conclusions inevitably requires making some assumptions.

Despite its limitations, the research paves the way for the future research within mobile broadband. One possibility can be utilization of other sharing concepts to study cooptitive business models. In addition, it could be possible to research how the business models of incumbent spectrum users are influenced by multiple cooptitive relationships with several MNOs. From the theoretical perspective, part of the findings indicates that researchers should consider cooptition also in ecosystemic business contexts.

## 7. Conclusions

Finally, we will draw our conclusions including the empirical and conceptual findings by using the business model conceptualization presented in chapter 3.2: when, what, how, why, and where.

### When?

It seems evident that spectrum sharing may become meaningful for MNOs in the future when there are enough

users and paying customers available. Even more importantly, there has to be enough spectrum available for long enough time for the MNOs, so that it is safe for the MNOs to invest in the necessary network infrastructure. The LSA concept as an opportunity must be indicating clear value co-creation potential for the MNOs. For the incumbents, sharing may in the future become meaningful as a result of three things. First, if they can avoid re-farming, i.e., losing the spectrum they currently use, which gives them operational certainty to continue in the future. Second, there might also be an opportunity for the incumbent to get additional income, given that it is allowed by legislation or regulator as a new source of revenue in the future. Third, there might also be an opportunity for the incumbents to avoid high spectrum costs by allowing sharing in case regulators enforce market prices on the incumbents' spectrum use indicating potential cost savings in the future. These two items are related directly to incumbents' value co-capture potential.

### What?

In practice the incumbents and MNOs operate and provide different wireless services and value propositions to different customer or industry segments. Also, the different need for the spectrum can be seen as a basis for differentiation. In LSA they would share the same spectrum for different type of operations. These differences and parallel functioning of the offerings, value propositions and differentiation allows sharing to take place as MNOs' and incumbents' customers could sometimes even be the same, but services and usage patterns are different. From theoretical perspective, the value co-creation and co-capture processes when seen from customer perspective can be regarded as separate for the incumbents and MNOs. The offering of both MNOs and incumbents are influenced by licensing terms and sharing conditions and the governments and regulators have a strong influence over these terms. As there can be different constellations for resource availability and use for MNOs—in temporal, spatial or spectral terms—the competitive situation may vary between the players in this respect, too. Regarding co-competition, there will be all the time competition over the same scarce resource, the spectrum. In some cases, however, incumbents could benefit from the infrastructure of the MNOs, for example as regards connectivity. Therefore, the customer, offering, value proposition, and differentiation related choices of the MNOs and incumbents can act as an enabling factor for value co-creation and co-capture, and they may lead to co-competition between the players.

### How?

To start with, selling and marketing could be expected to remain separate for incumbents and MNOs within spectrum sharing as LSA as a concept is at the different level of operation. However, regarding key activities LSA concept establishes collaboration between an incumbent and an MNO at several technical layers from spectrum usage level (controllers) to information sharing, especially

regarding the availability of spectrum for which the information is stored in one or several repositories. For MNOs the basis of advantage the LSA might bring is that it is an easy source of additional spectrum with flexible usage conditions provided that involved parties agree to share. Thus, it can be seen as a value co-creation and co-capture enabler. Similarly, it can act as a cost-efficient solution to growing customer demand and to avoid expensive network densification, therefore, working as a value co-capture enabler. For the incumbents one of the advantages in inter-incumbent collaboration could be the ability to coordinate spectrum use. It would offer better quality for both incumbents with low additional cost, which in turn might open up more spectrum opportunities for the MNOs. Thus, this could also act as a value co-creation opportunity for the MNOs and as a value co-capture opportunity for the incumbents. Regarding the mode of service delivery, there are currently different infrastructures/equipment used by the incumbents and MNOs to deliver their services. However, in the future the infrastructures could be partly or to some degree shared with LSA, enabling value co-capture. It has to be remembered that a direct connection between the incumbents and MNOs is under the regulator's governance. As a summary of the discussion around the question how, we can see key activities, basis of advantage, selling and marketing, and mode of delivery as enabling factors for value co-creation and co-capture, which in turn may lead to co-competition between the LSA stakeholders.

### Where?

This question deals with the issue who of the stakeholders is doing what in LSA, therefore, being related to value co-creation, co-capture, and co-competition between the stakeholders. Additionally, the question where concerns also all other elements of the business model concept and we have also partly covered this question in the preceding discussion. Some additional points are worth of a closer examination. First, the spectrum repository or who controls/operates it in practice should not in principle influence the value co-creation and co-capture processes of the incumbents and MNOs. Second, as there are different temporal, spatial, and spectral constellations of resource availability and use, for the challenger MNOs the question where might be much more important than for the dominant ones. Third, the type of compensation for the spectrum resource, i.e., who is paying/compensating to whom and how, may influence the infrastructure-related collaboration between incumbents and MNOs.

### Why?

The question why is related to the financial/compensatory aspects of the business: the basis of pricing, way of charging, cost elements, and cost drivers. The regulators' role cannot be overestimated here as set the framework for determining the price that MNOs and incumbents must pay over spectrum. The structure of payment between incumbent and an MNO can be evaluated to influence value co-capture as co-capture varies regarding to whom

the payments/compensation might go in LSA (government or incumbent). There are different payment schemes over the spectrum licenses, e.g. exclusive licenses for mobile use (by MNOs) in some cases are paid annually without any interest rates. The payment scheme might influence competitive situation and cooperation opportunities of MNOs. Currently there is and in the future there are expected to be various models for pricing over the spectrum, revenue or cost-based ones: freemium (free of charge for the end user), fixed, pay per usage, or percentage of revenue/profit/sales margin based. The type of cooperation between the stakeholders, e.g., the level of information sharing required between the MNOs and incumbents can also be seen to influence the basis of invoicing. A new, emerging issue is in-kind compensation between MNOs and incumbents. Depending on the type of cooperation, there is an opportunity for the incumbents to use MNOs' networks for incumbents' own services and internal use (e.g. in the form of infrastructure sharing). It appears not to be necessary that in all cases the incumbent should pay over the use of spectrum, but use it free of charge.

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### References

- [1] Report ITU-R M.2243. Assessment of the global mobile broadband deployments and forecasts for International Mobile Telecommunications. 2011.
- [2] Ahokangas, P., Matinmikko, M., Yrjölä, S., Okkonen, H. & Casey, T. (2013). "Simple Rules" for mobile network operators' strategic choices in future cognitive spectrum sharing networks. *IEEE Wireless Communications Magazine* 20(2): 20-26.
- [3] Timmers, P. (1998). Business models for electronic markets. *Electronic Markets* 8(2): 3-8.
- [4] Teece, D. (2010). Business models, business strategy and innovation. *Long Range Planning* 43 (2-3): 172-194.
- [5] Baden-Fuller, C. & Morgan, M.S. (2010). Business models as models. *Long Range Planning* 43(2-3): 156-171.
- [6] Sabatier, V., Mangematin, V. & Rousselle, T. (2010). From recipe to dinner: Business model portfolios in the European Biopharmaceutical industry. *Long Range Planning* 43(3-4): 431-447.
- [7] Magretta, J. (2002). Why business models matter. *Harvard Business Review*, May: 86-92.
- [8] George, G. & Bock, A.J. (2011). The business model in practice and its implications for entrepreneurship research. *Entrepreneurship Theory and Practice* 35(1): 83-111.
- [9] Chesbrough, H. (2010). Business model innovation: opportunities and barriers. *Long Range Planning* 43(2-3): 354-363.
- [10] Smith, W.K., Binns, A. & Tushman, M.L. (2010). Complex business models: Managing strategic paradoxes simultaneously. *Long Range Planning* 43 (2-3): 448-461.
- [11] Tikkanen, H., Lamberg, J.-A., Parvinen, P. & Kallunki, J.-P. (2005). Managerial cognition, action and the business model of the firm. *Management Decision* 43 (6): 789-809.
- [12] Zott, C., Amit, R. & Massa, L. (2011). The business model: Recent developments and future research. *Journal of Management* 37(4): 1019-1042.
- [13] Ahokangas, P. & Myllykoski J. (2013). Creating and transforming business models as a practice. Paper presented at the 22nd Nordic Academy of Management conference, 21-23 August, Reykjavik, Iceland.
- [14] McGrath, R.G. (2010). Business models: A discovery driven approach. *Long Range Planning* 43 (2-3): 247-261.
- [15] Bengtsson, L. & Kock, S. (2000). Coopetition in business networks: To cooperate and compete simultaneously. *Industrial Marketing Management* 29: 411-426.
- [16] Gnyawali, D. & Park, B. (2011). Coopetition between giants: Collaboration with competitors for technological innovation. *Research Policy* 40: 650-663.
- [17] RSPG13-538. RSPG Opinion on Licensed Shared Access, Radio Spectrum Policy Group, Brussels. 2013.
- [18] ECC Report 205. Licensed Shared Access. Electronic Communications Committee. 2014.
- [19] Gnyawali, D. & Park, B. (2009). Coopetition and technological innovation in small and medium-sized enterprises: A multilevel conceptual model. *Journal of Small Business Management* 47(3): 308-330.
- [20] Lynn, G.S. & Akgün, A.E. (1998). Innovation strategies under uncertainty: A contingency approach for new product development. *Engineering Management Journal* 10(3): 11-17.
- [21] Tether, B. (2002). Who cooperates for innovation, and why: An empirical analysis. *Research Policy* 31: 947-967.
- [22] Johannessen, J.-A. & Olsen, B. (2010). The future of value creation and innovations: Aspects of a theory of value creation and innovation in a global knowledge economy. *International Journal of Information Management* 30: 502-511.
- [23] Bengtsson, M. and Kock, S. (2014). Coopetition – Quo vadis? Past accomplishments and future challenges. *Industrial Marketing Management* 43: 180-188.
- [24] Padula, G. & Dagnino, G. (2007). Untangling the rise of coopetition: The intrusion of competition in a cooperative game structure. *International Studies of Management and Organization* 37(2): 32-52.
- [25] Vickers, J. (1995). Concepts of competition. *Oxford Economic Papers* 47(1): 1-23.
- [26] Brandenburger, A. & Nalebuff, B. (1996). *Coopetition*. New York: Doubleday.
- [27] Bengtsson, M., Eriksson J. & Wincent, J. (2010). Coopetition dynamics – outline for further inquiry. *International Business Journal* 20(2): 194-214.
- [28] Gnyawali, D. He, J. & Madhavan, R. (2008). Coopetition: Promises and challenges. In Wankel, C. (ed.). *21st Century Management*. CA: Thousand Oaks, 386-398.
- [29] Chen, M. (1996). Competitor analysis and interfirm rivalry: Toward a theoretical integration. *Academy of Management Review* 21(1): 100-134.
- [30] Lado, A., Boyd, N. & Hanlon, S. (1997). Competition, cooperation, and the search for economic rents: A syncretic model. *Academy of Management Review* 22(1): 110-141.

- [31] Bengtsson, M., Johansson, M., Näsholm, M. & Raza-Ullah, T. (2013). A systematic review of coopetition; levels and effects at different levels. 13th EURAM Conference, Istanbul, Turkey, June 26-29.
- [32] Wu, J. (2014). Cooperation with competitors and product innovation: Moderating effects of technological capability and alliances with universities. *Industrial Marketing Management* 43: 199-209.
- [33] Shafer, S., Smith, H. & Linder, J. (2005). The power of business models. *Business Horizons* 48 (3): 199-205.
- [34] Morris, M., Schindehutte, M., Richardson, J. & Allen, J. (2006). Is the Business Model a useful Strategic Concept? Conceptual, Theoretical, and Empirical Insights. *Journal of Small Business Strategy* 17(1): 27-50.
- [35] Chesbrough, H. & Rosenbloom, RS. (2002). The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change* 11(3): 529-555.
- [36] Walley, K. (2007). Coopetition: An introduction to the subject and an agenda for research. *International Studies of Management and Organization* 37(2): 11-31.
- [37] Richardson, J. (2008). The business model: an integrative framework for strategy execution. *Strategic Change* 17: 133-144.
- [38] Ritala, P. & Hurmelinna-Laukkanen, P. (2009). What's in it for me? Creating and appropriating value in innovation-related coopetition. *Technovation* 29: 819-828.
- [39] Kotzab, H. & Teller, C. (2003). Value-adding partnerships and Coopetition models in the grocery industry. *International Journal of Physical Distribution and Logistics Management* 33(3): 268-281.
- [40] Osterwalder, A., Pigneur, Y. & Clark, T. (2009). Business model generation: A handbook for visionaries, game changers, and challengers.
- [41] Onetti, A., Zucchella, A., Jones, M. & McDougall-Covin, P. (2012). Internationalization, innovation and entrepreneurship: business models for new technology-based firms. *Journal of Management and Governance* 16(3): 337-368.
- [42] Vargo, S. & Lusch, R.F. (2008). Why "service"? *Journal of the Academy of Marketing Science* 36: 25-38.
- [43] Ardichivili, A., Cardozo, R. & Ray, S. (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing* 18: 105-123.
- [44] Zott, C. & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning* 43(2-3): 216-226.
- [45] Shane, S. (2003). *A General Theory of Entrepreneurship: The Individual-Opportunity Nexus*. Edward Elgar: Cheltenham, U.K.
- [46] Nielsen, C. & Bukh, P.N. (2011). What constitutes a business model: the perception of financial analysts. *International Journal of Learning and Intellectual Capital* 8(3): 256-271.
- [47] Ritala, P., Golnam, A. & Wegmann, A. (2014). Coopetition-based business models: The case of Amazon.com. *Industrial Marketing Management* 43: 236-249.
- [48] Stevenson, T. (2002). Anticipatory action learning: conversations about the future. *Futures* 34: 417-425.
- [49] Inayatullah, S. (2006). Anticipatory action learning: Theory and practice. *Futures* 38: 656-666.
- [50] Susman, G. & Evered, R. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly* 23: 582-603.
- [51] Reason, P., & Bradbury, H. (Eds.). (2008). *The SAGE Handbook of Action Research* (2nd ed.). Sage Publications Inc.: London.
- [52] Pedler, M. & Burgoyne, J. (2008). Action Learning. In Reason, P. & Bradbury, H. (eds.). *The SAGE Handbook of Action Research* (2nd ed.). Sage Publications Inc., London: 319-332.
- [53] Tsoukas, H. & Shepherd, J. (2004). *Managing the future: Foresight in the knowledge economy*. Blackwell Publishing Ltd.: USA.
- [54] Ramos, J. (2006). Dimensions in the confluence of futures studies and action research. *Futures* 38: 642-655.
- [55] Wilber, K. (1997). An integral theory of consciousness. *Journal of consciousness studies* 4(1): 71-92.
- [56] Inayatullah, S. (2008). Six pillars: Futures thinking for transforming. *Foresight* 10(1): 4-21.
- [57] Slaughter, R. (2005). *Futures beyond Dystopia*. Routledge: London.
- [58] Ahokangas, P., Matinmikko, M., Yrjölä, S., Mustonen, M., Posti, H., Luttinen, E. & Kivimäki, A. (2014b). Business models for mobile network operators in Licensed Shared Access (LSA). *IEEE DySPAN*, McLean, VA, US, April 1-4.
- [59] Ahokangas, P., Matinmikko, M., Yrjölä, S., Mustonen, M., Luttinen, E., Kivimäki, A. & Kemppainen, J. (2014a). Business scenarios for incumbent spectrum users in Licensed Shared Access (LSA). Paper presented at 9th International Conference on Cognitive Radio Oriented Wireless Networks (CrownCom) June 2-4, 2014, Oulu, Finland.