Business Models Analysis for Multiplex Operators in the Process of Digitization

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***Abstract*—This article examines two business models for multiplex (MUX) operators in the process of digitization: Business model 1, where a MUX operator rents the existing network infrastructure and Business model 2, where a MUX operator owns the network infrastructure. By examining these models, this article aims to show which business model and which standard are most cost efficient for digital television implementation in Bosnia and Herzegovina. This analysis shows that a good MUX operator business model is very important for digital television implementation. Three different scenarios point to the fact that the transmission system significantly affects the cost of the MUX operator. Through this analysis, it will be determined that Business model 2 is more economical for Bosnia and Herzegovina.**

Keywords-broadcasters; business models; investment costs; legal framework; MUX operator.

I. INTRODUCTION

Regional Radio-communication Conference RRC-06 was held in Geneva, from 15 May to 16 June 2006 with a goal of setting the plan of spectrum usage for the radio diffusion needs in Europe, Africa and parts of Asia. According to GE-06 agreement, the process of transition to digital broadcasting is to be done in Very High Frequency (VHF) III (174-230 MHz) and Ultra High Frequency (UHF) IV/V (470-862 MHz) bands. This agreement states June 17, 2015 as the date of completion of the transition process [1].

Digital television allows broadcasters to offer new and different services to its customers, which include significantly improved reception, with fewer interruptions and errors in transmission, wide screen format, Standard Definition Television (SDTV), High Definition Television (HDTV), high quality sound, Electronic Program Guide (EPG), radio programs, multicasting and data casting [2].

The provision of digital television requires MUX operator that provides television and radio programs, digital content added services, electronic communication services and other associated identification signals and data.

Since digital broadcasting has still not begun in Bosnia and Herzegovina, this paper provides a brief overview of the situation in Bosnia and Herzegovina. After that, potential business models will be proposed for MUX operators. In accordance with the analysis of the situation in Bosnia and Herzegovina, economic analysis will be carried out in order to determine which digital television standard is best for implementation, and thus determine which business model is the optimal one.

II. DIGITAL TELEVISION IN BOSNIA AND HERZEGOVINA

A. Regulatory and Legal Aspects od Digital Terrestrial Television Introduction

Bosnia and Herzegovina initiated the process of transition to digital broadcasting in time. By establishing the Digital Terrestrial Television (DTT) forum of Bosnia and Herzegovina (in 2006), with operational work of the secretariat and working groups (in 2007), and based on a debate in the communications sector and successful regional cooperation in this field, the Council of Ministers has adopted the strategy document for the transition to digital broadcasting in 2009. This strategy document provides guidance to the relevant institutions in this area, informs interested parties in the communications sector and approaches this subject to citizens. As the development and adoption of the action plan, proposed in a strategy document, are in a serious delay, the steps required for analogue broadcasting turn off could not have been implemented until December 1st, 2011, as was scheduled by the strategy [3].

B. Technological Aspects of DTT Introduction

The key players for DTT introduction are shown in Figure 1, adapted from [4]. This figure shows that there are three key players in the process of delivering digital services:

1. Content and Application Service Providers (CASP) provide content and applications and after that this content is distributed towards interconnection points with Network Service Providers (NSP), where such content is concentrated and packed with contents from other CASPs.
2. NSP provides program transmission to DTT MUX operator where the content is selected from the transmission network, and via DTT multiplexes forwarded to the transmitting site. One NSP is able

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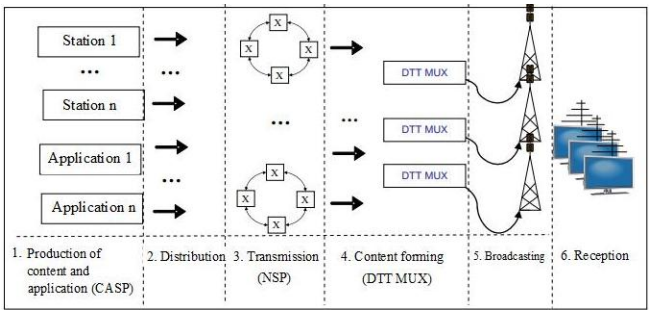

Figure 1. Key players in DTT market.

to transmit a greater variety of TV programs in its own network, while DTT MUX operator selects only those TV programs that have a license to broadcast in the network of that DTT MUX operator.

3. DTT MUX operator collects and marks the content and sends it as a digital multiplex, and then decides which Conditional Access (CA) and which Subscriber Management System (SMS) will be used.

Using the three key players has the following benefits [5]:

- Fast network disconnection, which is achieved by the NSP setting the transmitter, while the MUX operator is oriented to the SMS system, multiplexing and distribution;
- Increasing expansion of services;
- Smaller investments, because they are distributed to all three key players.

Disadvantages of having three key players are [5]:

- Higher complexity of the process of delivering content to users;
- As all three sides are mutually dependent on each other in the process of delivering the content to users in a case that one party violates the regulatory requirements, it causes inconvenience to other parties, as well as the disruption of service provision.

In order to avoid these shortcomings, there could be only two key players, CASP and MUX operator [5]. This way, complexity of the process of digital services delivery to end users is reduced and the management of the entire process is much easier. In this approach, MUX operator assumes the role of providing the infrastructure and management of the entire transmission process.

III. BUSINESS MODELS FOR MUX OPERATORS

Business modeling, and analysis of technical and economic aspects of business strategies and opportunities, has an increasingly important role in scientific research. Various researchers, in different contexts, presented several different definitions of business models. Teece [7] talk about importance of business models:

"Whenever a business is established, it either explicitly or implicitly employs a particular business model that describes the architecture of the value creation, delivery, and capture mechanisms employed by the business enterprise. The essence of a business model is that it defines the manner by which the business enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit: it thus reflects management's hypothesis about what customers want, how they want it, and how an enterprise can organize to best meet those needs, get paid for doing so, and make a profit."

Each MUX operator should be supported by a successful business model. A MUX operator is essentially a service provider as a standardized signal flow for digital broadcasting systems. That flow, in addition to television and radio programs, includes additional digital services, electronic communications services and other associated identification signals and data.

The main MUX operator functions can be summarized as follows:

- Establishing, operating and developing multiplexes;
- Providing and managing connections with the CASPs;
- Providing and managing the delivery of multimedia services to end users;
- Compliance with the requirements of regulators, in accordance with the permit.

The number of MUX operators in one country depends on how much coverage should be achieved or for which broadcasters MUX operator is intended.

Regarding the coverage, we have the following MUX operators [5]:

- MUX operators for national coverage;
- MUX operators for regional coverage;
- MUX operators for local coverage.

Regarding their purpose, we have following MUX operators [5]:

- MUX operators for public broadcasters;
- MUX operators for commercial broadcasters;
- MUX operators for value added services.

For the digital television broadcasting, in the beginning, it is recommended to use two MUX operators, one MUX for public broadcasters (MUX A) and one MUX for commercial broadcasters (MUX B, by allotments), where a public MUX can also broadcast commercial CASP services in order to encourage the competition [5]. The existence of one MUX operator for value added services in the begginig of this process would be counter productive and would not make any sense from a business aspect.

Two potential business MUX operator models will be described in the next section. Participants, their relationships, streams of revenue and cost generators are presented for each model.

The black arrows in each of the business models represent the direction of the flow of services, while revenue streams are represented by red arrows. The ellipse on each scheme represents a participant, while a rectangle inside the ellipse represents the role of the participant. One participant may have one or more roles.

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TABLE I. INCOME AND OUTCOME FLOWS FOR KEY PLAYERS

Players	Roles	Income		Outcome	
		Interface	Flow	Interface	Flow
MUX operator	Content aggregation and multiplexing, network provider	Cont_Whl	Subscription for content transmission	Cap_Whl	The cost of content transmission
		VA_Ser	Subscription for value added services transmission	Internally	Attracting customers, marketing, commissions, charges, aggregation, multiplexing and transmission costs, operations, upgrade, and maintenance costs for DVB access and transmission networks
Content provider	Content provider	Subscription	Subscription for the content and advertising	Cont_Whl	The cost of purchasing the rights of content owners and subscription fees for the transfer of content
Content producer	Content producer /content owner	Cont_Whl	Revenue from the sale of rights to content provider	Internally	Investment cost for creating new content
Value added services provider	Value added services provider	Subscription	Revenues from end users for value added services	VA_Ser	Subscription fees for the transfer of content
				Internally	Investment cost for creating new services

A. *Business Model 1 – Digital Broadcasting in which MUX Operator Takes a Lease of the Existing Network Infrastructure*

The business model that is shown in Figure 2 describes the scenario of providing broadcasting services to the end user. MUX operators obtain the content in the wholesale from various participants and also have a role of content collectors, by collecting more TV programs or data sequences on the broadcast channel. On the other side, NSP manages the broadcasting network and sells the capacity to MUX operator. In other words, MUX operator does not own the network infrastructure, so it rents it from NSP. It is important to mention that, in case of commercial content providers, their income does not come from subscriptions for content usage, as is the case with public content providers, but from the companies that advertise through them. The key participants in this model are MUX operator, NSP operator, content provider, content producer, the owner of content, and value added services provider.

Table I shows flows of income and outcome for key players in Business model 1.

B. *Business Model 2 – Digital Broadcasting in Which MUX Operator Owns Network Infrastructure*

Business model 2 is shown in Figure 3.

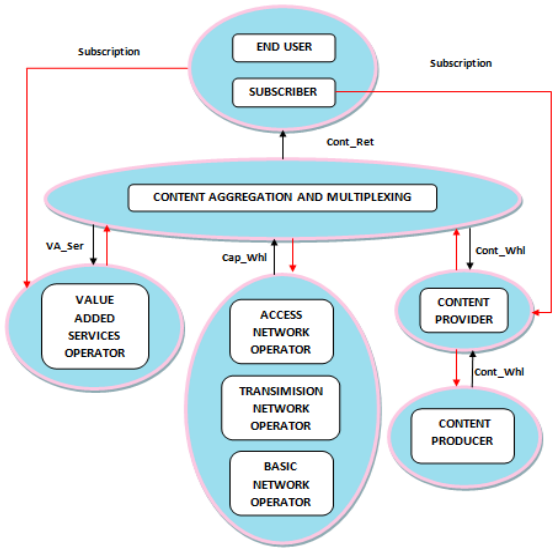

Figure 2. Business model 1 – Digital broadcasting in which MUX operator rents the existing network infrastructure.

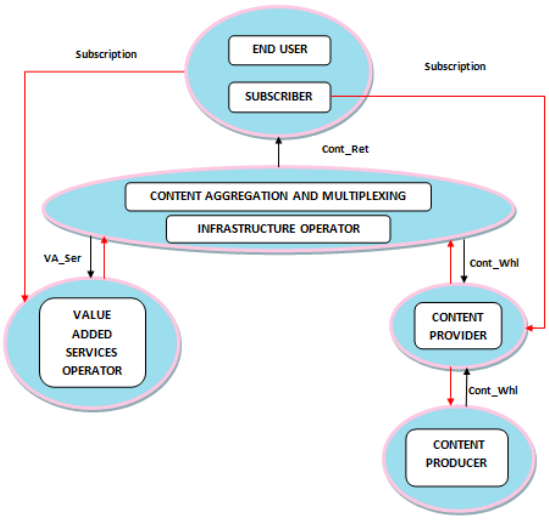

Figure 3. Business model 2 – Digital broadcasting in which MUX operator owns network infrastructure.

TABLE II. INCOME AND OUTCOME FLOWS FOR KEY PLAYERS

Players	Roles	Income		Outcome	
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Value added services provider	Value added services provider	Subscription	Revenues from end users value added services	VA_Ser	Subscription fees for the transfer of content
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IV. ECONOMIC ANALYSIS OF INTRODUCING MUX OPERATORS IN BOSNIA AND HERZEGOVINA

This section provides a cost estimation for the construction of MUX network for commercial broadcasters, MUX B. This study is based on the fact that the coverage of population with digital signal is proportional to the current coverage with analog signal. UHF channels are assigned to MUX B and it can transmit up to 8 programs on one channel. This means that the MUX operator revenues will be by 8 emitters. During the construction of this network, there is one MUX operator with national coverage. In the business world, the optimum time for paying back the invested resources is 8 years, so this analysis will also take 8 years as the time for paying back investments for MUX operators. In addition to that, this analysis has predicted the period of nine months as the optimal time to install the necessary equipment.

Initial costs are all those costs that MUX operator will have prior to equipment installation and start-up. These costs include purchase of head-end system equipment, transmission system and transmitter system. Also, these costs may include the cost of paying for permits and purchase of frequencies [6].

Both initial and total costs of MUX operators depend on which transmission system will be used, as well as the price that CASPs will pay to MUX operators. All initial costs are shown in Table III.

In order to determine which transmission system is the most economical, three scenarios will be considered to estimate the total cost of MUX operator.

TABLE III. INITIAL COSTS OF MUX OPERATOR

Initial costs parameter	Price(EUR)
Head-end system	250,000.00
Work permit (first year)	15,000.00
Satellite segment renting (first year)	2,000,000.00
Transmission links renting (first year)	1,000,000.00
Satellite transmission system equipment	383,000.00
Terrestrial transmission system equipment	2,000,000.00
Transmitter system equipment	8,000,000.00

A. *Scenario 1 – Total Costs of MUX Operator in a Case When a Transmission is Done via Satelitte*

As the transmission is done by using a satellite, it is necessary to rent a satellite segment. According to Table III, we have following investment costs:

- Head-end system – 250,000.00 EUR;
- Work permit – 15,000.00 EUR;
- Satellite segment renting – 2,000,000.00 EUR;
- Satellite transmission system equipment – 383,000.00 EUR;
- Transmitter system equipment – 8,000,000.00 EUR.

The total initial costs amount to 10,648,000.000 EUR. After these costs, it is necessary to install the purchased equipment. In addition, payment of work licenses, frequency renting and satellite segment renting contribute to the amount of total costs. Also, a significant part of the costs come from the electronic equipment amortization, where the rate of amortization is 20%. All of the costs mentioned above are shown in Table IV.

The total costs for this scenario are approximately 34,230,000.00 EUR. At the annual level, these costs amount to 4,300,000.00 EUR. If we take into consideration that

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MUX operator serves 8 emitters, the annual fee for one emitter in this scenario is approximately 540,000.00 EUR.

B. *Scenario 2 – Total Costs of MUX Operator in a Case When a Transmission is Done via Rented Terrestrial Links*

In this case, a MUX operator rents links for transmitting content towards transmission sites. Initial costs are now:

- Head-end system – 250,000.00 EUR;
- Work permit – 15,000.00 EUR;
- Transmission link renting – 1,000,000.00 EUR;
- Transmitter system equipment – 8,000,000.00 EUR.

All costs that the MUX operator has in this scenario are shown in Table V.

The total costs for this scenario are approximately 25,500,000.00 EUR. At the annual level, these costs amount to 3,187,500.00 EUR. The annual fee for one emitter in this scenario is approximately 400,000.00 EUR.

C. *Scenario 3 – Total Costs of MUX Operator in a Case When the Operator Owns the Transmission Network*

In this scenario, a MUX operator owns a transmission network. This means that it needs to buy transmission system equipment and install it. Therefore, the initial costs will change. According to this, we have the following investment costs:

- Head-end system – 250,000.00 EUR;
- Work permit – 15,000.00 EUR;
- Transmission system equipment – 2,000,000.00 EUR.
- Transmitter system equipment – 8,000,000.00 EUR.

All costs for MUX operator, for this scenario, are shown in Table VI.

The total costs for this scenario are approximately 21,300,000.00 EUR. At the annual level, these costs amount to 2,660,000.00 EUR, which means that annual fee for one emitter in this scenario is approximately 350,000.00 EUR.

TABLE IV. SUMMARY OF MUX OPERATOR COSTS FOR SCENARIO 1

Cost parameter	Price (EUR)
Total initial costs	10,648,000.000
Costs of satellite transmission system equipment installation	39,000.00
Costs of transmitter system equipment installation	2,355,000.00
Work permit costs	105,000.00
Costs of frequency renting	100,000.00
Costs of satellite segment renting	14,000,000.00
Costs of satellite transmission system equipment amortization	325,000.00
Costs of transmitter system equipment amortization	6,658,000.00

TABLE V. SUMMARY OF MUX OPERATOR COSTS FOR SCENARIO 2

Cost parameter	Price (EUR)
Total initial costs	9,265,000.00
Costs of transmission links renting	7,000,000.00
Costs of transmitter system equipment installation	2,355,000.00
Work permit costs	105,000.00
Costs of frequency renting	100,000.00
Costs of transmitter system equipment amortization	6,658,000.00

VI. SUMMARY OF MUX OPERATOR COSTS FOR SCENARIO 3

Cost parameter	Price (EUR)
Total initial costs	10,265,000.00
Costs of transmission system equipment installation	55,000.00
Costs of transmitter system equipment installation	2,355,000.00
Work permit costs	105,000.00
Costs of frequency renting	100,000.00
Costs of terrestrial transmission system equipment amortization	1,665,000.00
Costs of transmitter system equipment amortization	6,658,000.00

D. *Result Analyzis*

The cost recovery Curves of the MUX operator for the three analyzed scenarios is shown in Figure 4.

Initial investment costs are highest for Scenario 1, which is primarily due to the payment of satellite segment rent at the beginning of the year. The minimum initial investment costs are for Scenario 2, because the costs of renting transmission links at the beginning of the year are less than half in comparison with renting a satellite segment.

The costs increase significantly in an eight year working period. A large contribution to those costs is renting a satellite band for Scenario 1, or renting transmission links for Scenario 2. These costs do not exist in the third scenario because the MUX operator has its own network.

The graph shows that the fastest payment refund is in the third scenario, where the curve has the highest slope. In one moment costs for the third scenario become lower than the costs in the second scenario. The reason for this is that in Scenario 3 MUX operator has its own network, so there is no need to pay for equipment renting.

Concerning the MUX operator, we can conclude that for digital television transmission in Bosnia it is best to use terrestrial transmission with its own transmission network, because the total cost is smaller, as well as the price that broadcasters would have to pay. It means that for MUX operator is better to use Business model 2. Because of the lower costs, broadcasters would be more inclined to agree to digitize their signals and transfer the same.

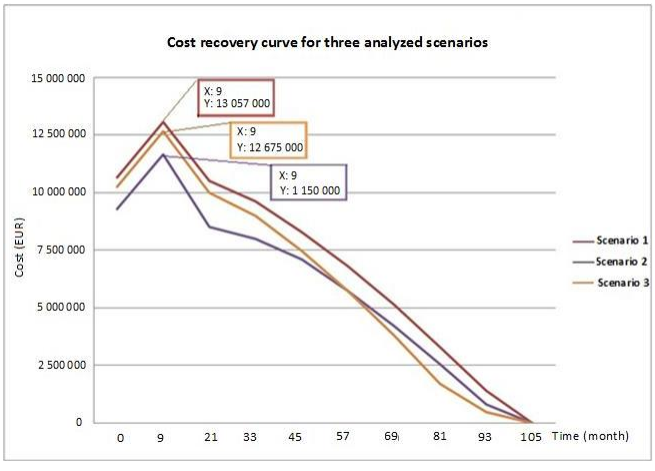

Figure 4. MUX operator cost recovery curve for three analyzed scenarios.

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The advantage broadcasters get in this case is the availability of their programs throughout the country.

By entering into this business, one can accurately calculate the costs that are expected for MUX operators and the price broadcasters will have to pay. Based on that price, it is possible to win over broadcasters before starting the operations, so the risk of investing in this business is low.

V. CONCLUSION AND FUTURE WORK

Transition to digital broadcasting frees the RF spectrum of the digital dividend, which has very favorable characteristics and provides an optimal balance between transmission capacity and coverage range.

The use of MPEG-4 standard for video compression and the use of DVB-T2 transmission technology, with a goal of more efficient use of the frequency spectrum, by facilitating the transmission of a higher number of channels per frequency, is an interesting option, especially for countries that have not yet completed the process of transition to digital broadcasting.

Two previously mentioned business models can be used as a startup framework for the implementation of MUX operator. The cost of introducing a MUX operator depends on the transmission system as could be seen from the economic analysis. The lowest costs that are expected for MUX operators are in the case of terrestrial transmission where MUX operator owns the network. In this case, the price paid by broadcasters is much lower and it is a great advantage, because that way the broadcasters will be more inclined to enter the process of digitization.

If there was a jump-start with a DVB-T2 standard in Bosnia, it would mean higher investment costs, approximately 100,000.00 EUR. In this case, the number of programs on one channel would increase to 16. This further leads to a much larger contributions. In that case, the MUX operator can reduce the cost of transmitting content to broadcasters and thus attract more broadcasters and increase the competition and interest in the market.

MUX operator would also transmit value added services such as interactive services, internet, etc. So their revenues would probably increase.

REFERENCES

[1] Communication Regulatory Agency, „Economic analysis of the need to introduce new services in Bosnia and Herzegovina“, Sarajevo, December 2012.

[2] Web: DigiTAG – Digital Terrestrial Television Action Group, www.digitag.org [retrieved: January, 2014].

[3] Communication Regulatory Agency, "Analysis of the legal framework for the introduction of DTT in [Bosnia and Herzegovina" project, Version A-1.1, 2012.

[4] DTT Forum of Bosnia and Herzegovina, “The strategy of transition from analogue to digital terrestrial broadcasting in the bands 174-230 MHz and 470-862 MHz in Bosnia and Herzegovina”, 2009.

[5] Rwanda Utilities Regulatory Agency, „Managing the change from analogue to terrestrial digital broadcast in Rwanda“, January 2008.

[6] Tanzania Communication Regulatory Authority, „Public consultation document on establishment of cost based transmission fee for digtial terrestrial television (DTT) charged by multiplex operators to content service providers“, November 2012.

[7] D. J. Teece, Business Modelfs, Business Strategy and Innovation, Long Range Planning 43, 2010, pp. 172–194.

 ISBN: 978-1-61208-324-7