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WiFi Data Offloading: Bundling Method in a Canvas Business Model

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***Abstract*—**Mobile operators deal with increasing in the data traffic as a critical issue. As a result, a vital responsibility of the operators is to deal with such a trend in order to create added values. This paper addresses a bundling method in a Canvas business model in a WiFi Data Offloading (WDO) strategy by which some elements of the model may be affected. In the proposed method, it is supposed to sell a number of data packages for subscribers in which there are some packages with a free given volume of data-offloaded WiFi complimentary. The paper on hands analyses this method in the views of attractiveness and profitability. The results demonstrate that the quality of implementation of the WDO strongly affects the final result and helps the decision maker to make the best one.

***Keywords*—**Bundling, canvas business model, telecommunication, WiFi Data Offloading.

I. Introduction

RADIOACCESS networks have been saturated and can no longer meet the needs of cellular users. In order to meet the bandwidth demand, WDO is employed. In communications technology, traffic growth, lower costs, and user demand for new services are components that have led to network architecture evolution. WDO is one of the architectures proposed for utilization of different access technologies to impose user data traffic for base stations. It is used to reduce the load and congestion in cellular networks. It is also used to provide better service quality and provide safer security mechanisms. Heavy competition and cost reduction are the main drivers of mobile operators in the world, as they have been forced to use innovative ways to keep costs competitive while maintaining competitive conditions.

Another important driver in determining the operator's route is the increasing demand for data, Cisco predicted that data consumption in the whole of the world is expected to equal 49 Exabyte in the year 2021 [1]. It is a good reason for mobile operators to use the WDO technique to reduce network currents [2]. It is not hard to encourage subscribers to use Wi-Fi, as the most subscribers have already experienced it. This method is mainly used in the telecommunications industry and in particular the mobile telecommunication one.

Generally, in the relative literature, the WDO is referred to as a win-win strategy. Of course, this process is not an issue and faces various challenges such as infrastructure, services, pricing, business models, and the lack of relevant standards [3]. Beneyam et al. [4] point out that among the existing strategies, it is considered as one of the most effective ones. Also, it should not be forgotten that Wi-Fi access is often seen as an added value that will appeal to consumers [5].

The shift and emergence of new and even more exciting technologies, the speed of change in stakeholder expectations, are the factors that make it necessary to strengthen and organize innovation in the organization. Innovation can take place in all parts of an organization. By deploying a framework, one can identify and implement the most appropriate strategy for achieving goals and vision. In fact, innovation can be defined as the invention of a product, a strategy, or a process. In the other words, innovation is a successful exploitation of new ideas.

We can mention that the innovation in the business model can be answering the existing and unmet needs of the market, introducing new technologies, products or services to the market, improving the revenue streams, and creating a completely new market. In many organizations, innovation efforts in the business model generally reflect the existing model and organization. The reason of these efforts is usually the occurrence of a crisis in the existing business model or improving the current conditions, introducing new technologies.

The design process of a business model includes some major steps like preparation, recognition, design, implementation, and management. Business model innovation is widely discussed (e.g. see [6]-[9]). Innovation in the business model is one of the most effective and, at the same time, least-used means for generating sustained profit growth, economic development, and the creation of new markets and industries. The paper on hand provides the readers with an innovative strategy where there is a Canvas business model. We address an innovative revenue stream, which is called the bundling strategy, for an internet service provider (ISP) called NAK in Iran in which the WDO is employed regarding a Canvas business model. In fact, Mokhtarnia and Amini [10], [11] presented and analyzed the business model, shown by Fig. 1, and this paper is an extension of those works. The Canvas business model has several advantages such as simplicity and being easy to implement [12]. Section II provides the readers with the details of the problem, and Section III analyzes some numerical cases.

II. Problem Description

Bundling is a service delivery method used to satisfy their customers. In fact, it is the concept of pricing and selling

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multiple goods as a package. It has been widely used by the telecommunication industry. For instance, operators, in the form of packages, integrate and supply some brands of cellphones with their services, which eventually ends up in the interest of all three parties - the cellphone producers, the operators and the subscribers. This kind of combination contains a given policy of pricing by the decision makers as an innovative way to create a new stream of revenue is providing the subscribers with the free Wifi-data-offloaded traffic. In a typical package, there are normal and overnight traffics. In general, overnight traffics are offered as a gift to the subscribers. The new strategy is concentrating on providing a second gift in a package called the WiFi traffic.

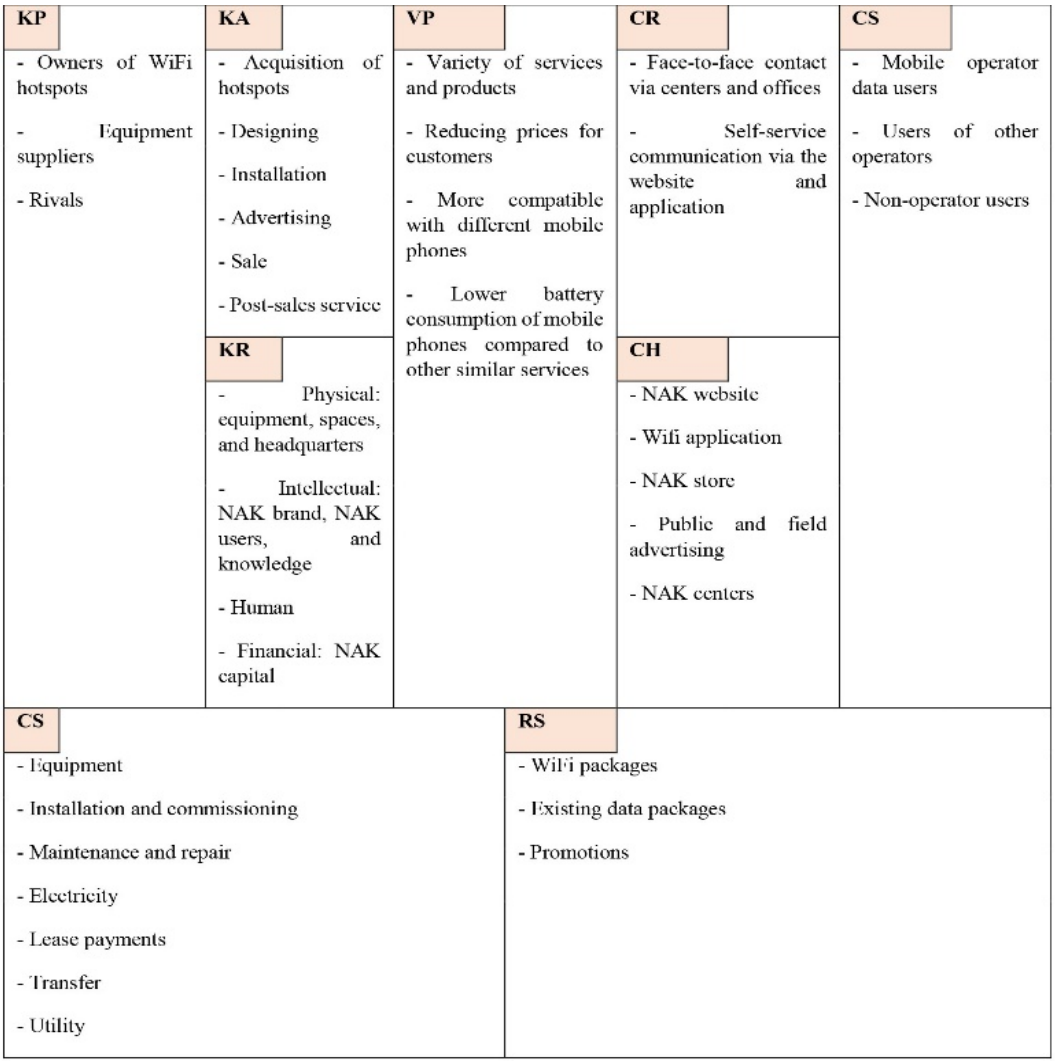

Fig. 1 The WDO Canvas of NAK [10]

The innovative method introduced by this article is to integrate the WDO strategy with the bundling of traffic data packets. It is, in fact, a balance between the costs of adding WiFi packages against the amount of customer attraction due to the new attraction created in the packages offered. This charm can be individually defined and examined on each package. In fact, one of the main assumptions is the existence of packet effects on each other and the incremental rate of each client's package individually. According to this assumption, it is possible to switch customers in the current customer portfolio between packages, and it would be possible to have new customers out of current portfolio. Keep in mind that WiFi traffic is supposed to be provided free as a gift to consumers. This model can serve as an input for a more general business model for this company. In fact, for the issue referred in this article, the WDO is defined as a solution for use in part of a general model. In this general model, WDO's advantage has been used to increase the probability of revenue streams.

There are |I| given packages in the considered bundling strategies. Each package includes two given capacities for a given period: daily and overnight traffics. In fact, the decision maker defines the periods. There is a defined offer for the WiFi traffic in each package. This offer is free of charge for the customer and can be available if the host provides it on the package. It means that some pre-specified packages include

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the WiFi-data-offloaded offer. The problem is to find the best packages for which this gift is presented. The attractiveness of a package can be defined in two ways:

i) Marginal profit of a package
j) ii) Specified packages

The following notations present what we are using in the paper.

i, j: Index of packages, D_i: The final number of subscribers of the i[th] package, $\overline{D}_i$: The nominal number of subscribers i[th] package, x_i: A binary variable which equals 1 if the WiFi is included in the i[th] package, α_i: Modification rate of the i[th] package if the WiFi is included within, β_{ij}: Attraction rate for the users of the j[th] package if the WiFi is included for the j[th] package, γ_{ij}: Churning rate for the users of the i[th] package if the WiFi is included for the i[th] package, P_i: Net profit of the i[th] package, E_i: Marginal profit of the i[th] package, W: WiFi cost per gigabyte (GB), w_i: WiFi traffic of the i[th] package.

It is assumed that each package is affected by the decisions made for other packages and it. In fact, we need to find the best offers by which $\sum_{I=1}^{|I|} P_i$ is maximized where $P_i = D_i(E_i - w_i W)$ and D_i is measured by (1).

$$P_i = D_i(E_i - w_i W)$$

$$D_i = \left\lceil (1 + x_i \alpha_i)\overline{D}_i + \sum_{j=1, j\neq i}^{|I|} (1 - x_j)\, \beta_{ij} \overline{D}_j + \sum_{j=1, j\neq i}^{|I|} x_j\, \gamma_{ij} \overline{D}_j \right\rceil \quad (1)$$

The problem is making an optimum decision about giving a package a free WiFi-offloaded-data traffic. It is found by studying the total net annual profit resulted from the possible increase in the number of customers in comparison with the increase in costs of providing the WiFi traffic.

This paper has three methods for sorting attractive packages from best to worst. These three methods arise from the above-mentioned approaches: marginal profit and specified packages. In fact, the first method (Case 1) packages are sorted based on the marginal benefit of each package from best to worst. The second method (Case 2) sorts these packages only according to the decision maker definition, and finally, the third method (case 3) uses both approaches simultaneously. In fact, we do not consider marginal profits for Case 2, while in Case 3, the sorting is firstly done according to the definition of the decision maker and then by the marginal profits as the secondary criterion. Then, based on the sorting, we will examine the presence or absence of WiFi traffic on each package. In this view, it is assumed that we begin the analysis with the most attractive package and continue it to the worst one. In fact, the study is done on the most attractive package, then we go to the two first one and so on to the end. In this way, depending on the parameters available, we can find attractive packages for providing WiFi traffic as a gift.

III. Numerical Analysis

This paper deals with the numerical analysis of the proposed methods in the problem. In this study, there are 10 packages with given traffics and parameters. Two different and independent sets of values are defined for each of the α_i, β_{ij}, and γ_{ij} parameters. In fact, these parameters and packages are based on studies conducted in real situations and are designed according to it. Table I shows the specifications of the proposed packages. In addition, Table II reports the result of the sorting of defined packages based on each of the three cases used. Then, Tables III and IV provide the value of β_{ij} and γ_{ij} for two sets.

TABLE I
PACKAGES

i	Traffic (GB) D	Traffic (GB) O	Traffic (GB) w_i	P	$\overline{D}_i \times 10^5$	E_i	α_i Set 1	α_i Set 2
1	2	2	2	1	4	2000	0.127	0.018
2	4	4	4	1	12	3200	0.165	0.205
3	8	8	4	1	8	2100	0.283	0.013
4	12	12	10	1	3.5	1900	0.126	0.022
5	20	20	15	1	3	1600	0.295	0.157
6	25	25	20	1	2	1700	0.091	0.030
7	50	25	25	1	1.5	1200	0.211	0.246
8	150	100	100	3	1	1000	0.200	0.246
9	500	250	250	6	3	1600	0.162	0.217
10	1000	500	500	12	2	1800	0.210	0.045

* D= Daily, O=Overnight, P=Periods by months

To analyze the problem, one needs to have the cost of every GB of the WiFi traffic. Since the optimal decision is made on the tradeoff between the W and the D_i, this paper will carry out a sensitivity analysis on W. It means that for each GB, there will be a fee of in the set {0,2,4,6,8,10}. In this example, it is assumed that monthly packages are considered as attractive ones.

TABLE II
THE RESULTS OF PACKAGES SORTING

Case 1	Case 2	Case 3
2	1	2
3	2	3
1	3	1
4	4	4
10	5	6
6	6	5
5	7	7
9	8	10
7	9	9
8	10	8

As Fig. 2 shows, the type of sorting has a great impact on the optimum number of WiFi-included packages (NoWP). As it is demonstrated, in Case 3, the total net profit may be greater. Of course, this is also significantly dependent on W. As expected, Wi-Fi allocations have a significant impact on the result. For example, in Case 1 of Set 1, assuming zero WiFi cost is the best decision making for WiFi traffic to the first seven attractive packages, while assuming W = 10, only the first three packets of this traffic should be assigned. This analysis is also valid for the other scenarios. On the other hand, it must be acknowledged that the parameters of α_i, β_{ij},

and γ_{ij} have a great influence on the reported trends in Fig. 2. This emphasizes that the correct and incorrect measurement of these parameters, in general, has a great impact on optimal decision-making, and the ISP poses a lower business risk.

TABLE III
THE VALUE OF β_{ij}

		1	2	3	4	5	6	7	8	9	10
Set 1	1	0	0	0	0	0.1	0.1	0.1	0.2	0.2	0
	2	0.1	0	0	0	0.2	0.2	0	0	0	0
	3	0.2	0	0	0	0	0.2	0	0.2	0	0
	4	0.1	0.1	0.2	0	0.2	0	0.1	0	0.1	0
	5	0	0	0.2	0	0	0	0.1	0	0	0.2
	6	0	0	0	0.2	0.1	0	0.2	0	0	0
	7	0	0.1	0.1	0	0	0	0	0.2	0.1	0
	8	0	0.1	0	0.1	0	0	0	0	0	0
	9	0	0	0	0	0.1	0	0	0.1	0	0
	10	0.1	0.1	0	0	0	0.1	0	0.1	0.1	0
Set 2	1	0	0	0	0.2	0.1	0	0.1	0	0	0
	2	0.1	0	0.1	0.2	0.1	0	0.1	0	0.2	0
	3	0.2	0	0	0	0	0	0	0	0.2	0
	4	0	0	0	0	0.1	0.1	0	0	0.1	0
	5	0	0	0	0	0	0	0	0	0	0
	6	0.1	0.1	0	0	0.1	0	0	0.2	0	0.1
	7	0	0	0.1	0.1	0	0	0	0.1	0.1	0
	8	0.2	0.1	0	0.2	0	0	0	0	0	0
	9	0	0	0	0	0.2	0	0	0.1	0	0
	10	0	0.1	0.1	0.2	0	0	0.1	0	0	0

TABLE IV
THE VALUE OF γ_{ij}

		1	2	3	4	5	6	7	8	9	10
Set 1	1	0	0	0	0	0.1	0.1	0.1	0.2	0.2	0
	2	0.1	0	0	0	0.2	0.2	0	0	0	0
	3	0.2	0	0	0	0	0.2	0	0.2	0	0
	4	0.1	0.1	0.2	0	0.2	0	0.1	0	0.1	0
	5	0	0	0.2	0	0	0	0.1	0	0	0.2
	6	0	0	0	0.2	0.1	0	0.2	0	0	0
	7	0	0.1	0.1	0	0	0	0	0.2	0.1	0
	8	0	0.1	0	0.1	0	0	0	0	0	0
	9	0	0	0	0	0.1	0	0	0.1	0	0
	10	0.1	0.1	0	0	0	0.1	0	0.1	0.1	0
Set 2	1	0	0	0	0.2	0.1	0	0.1	0	0	0
	2	0.1	0	0.1	0.2	0.1	0	0.1	0	0.2	0
	3	0.2	0	0	0	0	0	0	0	0.2	0
	4	0	0	0	0	0.1	0.1	0	0	0.1	0
	5	0	0	0	0	0	0	0	0	0	0
	6	0.1	0.1	0	0	0.1	0	0	0.2	0	0.1
	7	0	0	0.1	0.1	0	0	0	0.1	0.1	0
	8	0.2	0.1	0	0.2	0	0	0	0	0	0
	9	0	0	0	0	0.2	0	0	0.1	0	0
	10	0	0.1	0.1	0.2	0	0	0.1	0	0	0

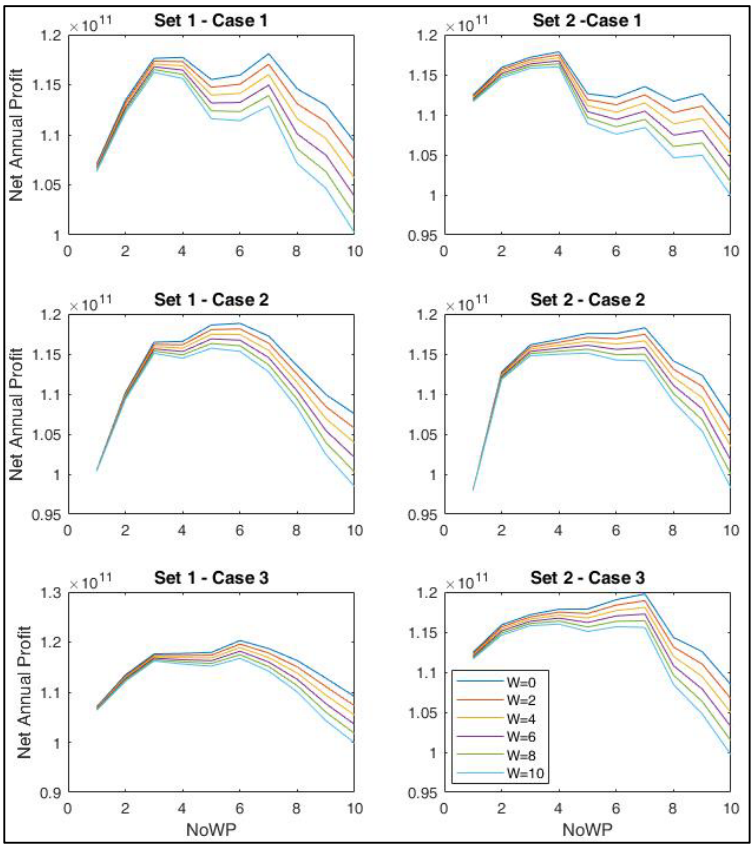

Fig. 2 Numerical results

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IV. Conclusion

This paper examined the provision of an innovative change to the revenue stream of an ISP using the WDO technique. In fact, this technique helps mobile subscribers to use the Internet on their phones easier. So, considering the WDO business model, we have used a data bundling strategy and provided a gift as WiFi traffic as an innovative solution. It should be noted that this gift leads to costs for the ISP and, on the other hand, can lead to an increase in customers or a shift in customers in the packages. In this paper, we ignored the assumption of customer loosing from the portfolio of primary customers. The careful consideration of this topic depends on the attractiveness of the proposed packages. As mentioned, we defined the attractiveness by using the two factors of marginal profit and specified attractiveness by the decision maker. By sorting this package from one of the most attractive to the most unattractive in three ways, the numerical issues were examined. The results demonstrated that the type of sorting as well as the accuracy of finding the correct values of the parameters has a significant effect in the final decision. In general, by considering the type of WDO implementation, the cost of WiFi also has a huge impact on optimal decision making. Investigating dynamic behavior of customers and the probability of losing customers from the current portfolio can be considered in future studies.

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