Business Process Management of Telecommunication Companies: Fulfillment and Operations Support and Readiness Cases

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Abstract

In this paper, we consider business process management for a certain business process of telecom companies. Generally, business process management is the management of flow of business activities in an effective and efficient way. If companies have effective and efficient business management process, that is a strong weapon for those companies in this fast changing business environments. This paper focuses on business process management of fulfillment and operations and support readiness business processes for telecom companies. For the fulfillment process, we derive recommended standard functions for a company with eTOM (Enhanced Telecom Operations Map). After deriving recommended standard functions, we draw business flow diagram for a certain process in the fulfillment. For operations support and readiness process we derive recommended standard functions for certain processes. In addition, we show some examples to evaluate process performance and optimize a function of a process. This paper is a very helpful guide to transform a company's business process or optimize it.

Keywords: *Business Process Management, eTOM, Process Improvement, Simulation*

1. Introduction

A business process can be described simply by a flow of business activities. Therefore, business process management (BPM) can be thought as the management of the flow of business activities. Nowadays, the BPM is a key survival factor for various companies such as telecommunication, information technology, and manufacturing companies since effective and efficient BPM can reduce operations cost of companies and make companies adapt to fast changing environments.

In this paper we consider BPM for telecommunication companies. Specially, this paper focuses on fulfillment and operations and support readiness (OSR) business processes for telecommunications companies. Similar to this research, the reference [1] studied service problem and resource trouble management processes. In [1] they derived primary necessary functions for process elements of eTOM (Enhanced Telecom Operations Map) and after comparing those functions with network management systems in a company they proposed an improvement direction of network operations and management for a company. However, the reference [1] did not consider business process flow diagram and quantitative business process analysis for fulfillment and OSR.

In addition to [1], the reference [2] studied a real time process management system. In [2], they developed a real time process management system that monitors and analyzes telecom operations and management processes in real time, especially for

problem handing, service problem and resource trouble management processes in eTOM. To develop the process management system, they introduced application and database architectures. In addition to these architectures, the [2] showed sample functions of the system. However, the [2] did not consider fulfillment and OSR processes in eTOM, either.

In this paper we study fulfillment and OSR processes in eTOM. For the analysis of these processes we first review the concepts of business process and BPM based on [3-5]. Then we introduce eTOM business process framework [6-9]. eTOM is a business process framework that defines all major business processes in telecom service providers. It is mainly used for telecom companies' business process innovation or improvement. After the introduction of BPM and eTOM, we show how to analyze certain business processes in fulfillment and OSR processes in eTOM. After the analysis, we describe how to evaluate the new business processes with simulation technique and how to optimize workforce as the examples of quantitative business analysis. These process evaluation and optimization techniques are very famous and important quantitative business analysis tools. Finally, we conclude this paper with conclusion and future research direction.

2. Business Process Management and eTOM

A business process can be described simply by a flow of business activities. Each process is an independent unit that transforms inputs into similar or different outputs but can interact with other processes [3, 5]. The readers can find many definitions of a business process in [5]. To evaluate and improve a business process we must examine the transformation of inputs into outputs. The five elements, inputs and outputs, flow units, network of activities and buffers, resources, information structure of a process characterize the transformation in Figure 1 [3]. For the detail explanation for the five elements, refer to [3].

In order to assess and improve the performance of a business process, we must measure it in quantifiable terms. Generally to measure a business process, financial, external, internal measures are used. Financial measures track the difference between the value provided to customers and the cost of producing and delivering the product. External measures track customer expectation in terms of product cost, response time, variety, and quality as well as, customer satisfaction with product performance along these dimensions. Internal measures track the performance of the process in terms of cost, low time, flexibility and quality. Internal performance measures can thus be a predictor of customer satisfaction and thus financial performance if customer expectations have been identified accurately [3]. In [3], you can see several methods to evaluate and improve the performance of a business process.

In telecommunication industry many telecom companies are now trying to adopt eTOM business framework for the business process management. If telecom companies want to have a standard way to describe their company's processes and identify processes that require changes when new strategies and goals are announced, they need a telecom process architecture like eTOM [4]. eTOM is a business process framework that defines all major business processes in telecom service providers. Actually, it is one of Next Generation Operations Systems and Software frameworks. It has almost four levels in details from 0 to 3 level in which 0 level shows the highest conceptual level of the eTOM and level 1 shows how the major process areas – Strategy,

Infrastructure & Product and Operations – are decomposed and levels 2 and 3 are further decomposition of the previous processes' view.

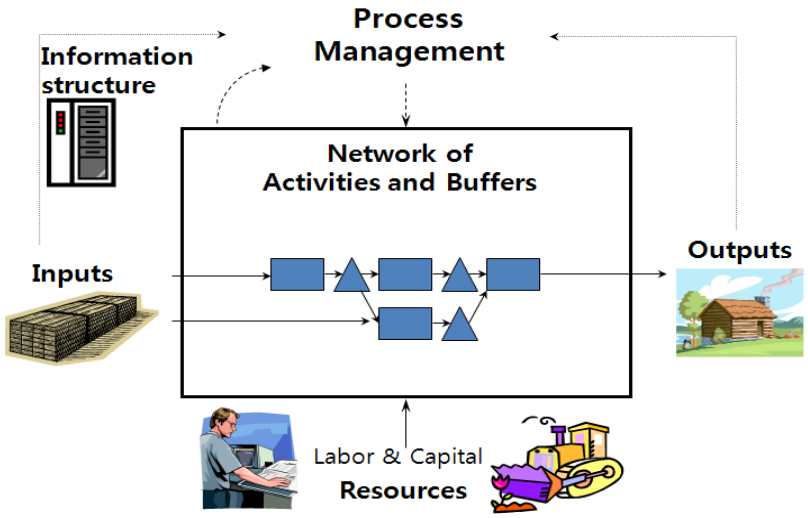

Figure 1: Concepts of Process and Process Management

The figure 2 is eTOM Level 1 process [6-9].

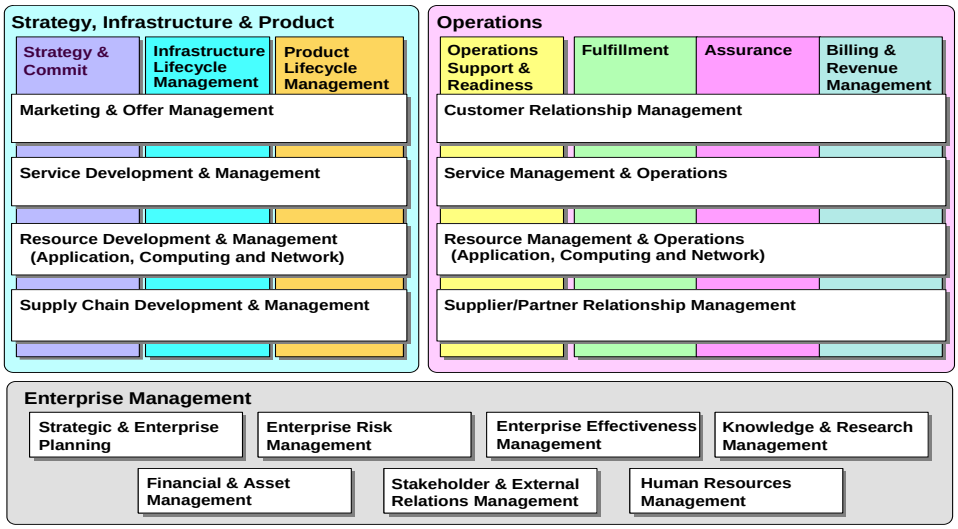

Fig. 2. eTOM Business Process Framework – Level 1 Processes

In the framework of eTOM level 1, fulfillment, assurance, billing (FAB) is the core processes of operation processes. In the figure 2, the horizontal processes represent functional view points and vertical processes represent business view points. Operations process shows flow and business elements for service fulfillment, assurance, billing and OSR. Strategy, infrastructure & product process for management and strategy of infrastructure and product life cycle supports this operations process. Since eTOM is

recognized as an international standard in ITU-T M.3050, we can use eTOM as a guideline when analyzing network operations and management processes. It is a reference framework for categorizing all the business activities that a service provider will use [10].

In [1], authors used eTOM to improve service problem management and resource trouble management. In [2, 10], authors built a real time process management system that monitors and analyzes telecom operations and management processes in real time, especially for problem handing, service problem and resource trouble management processes in eTOM and a field operations support system to improve the network operations and management processes, respectively. These three papers [1, 2, 10] are good examples of applying eTOM to real business processes and process improvement.

3. Business Process Analysis

In this section, we analyze fulfillment and OSR business processes of a telecom company with eTOM. By this analysis business process flow diagrams for certain business processes are obtained. Through this kind of analysis the business processes of telecom companies can be evaluated and to-be business processes can be derived.

3.1. Fulfillment Business Process Analysis

The figure 3 shows eTOM level 2 business processes in the operations area. The analysis in this subsection focuses on the fulfillment process.

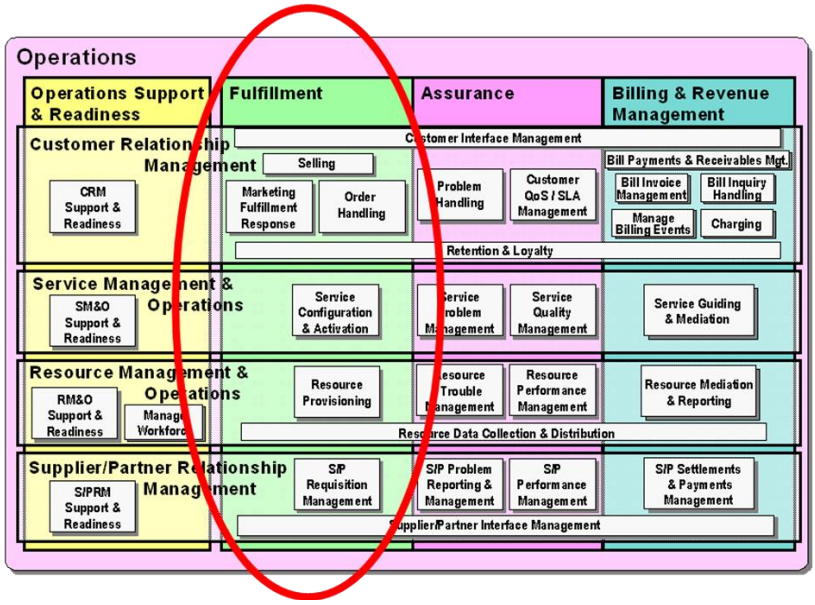

Fig. 3. Level 2 Business Processes in Fulfillment

Fulfillment process is responsible for providing customers with their requested products in a timely and correct manner. It translates the customer's business or personal need into a solution, which can be delivered using the specific products in the enterprise's portfolio. This process informs the customers of the status of their purchase order, ensures completion on

time, as well as ensuring a delighted customer [7, 9]. As in Figure 3, there are 10 level 2 business processes in the fulfillment.

To make to-be fulfillment business process for telecom companies that may want to reduce their operating cost or adapt to fast changing customers' needs, standard recommended functions of the eTOM level 2 processes in the fulfillment should be derived. Theses standard recommended functions will be used as reference functions that will be compared with the functions of the business processes of telecom companies. Theses standard recommended functions are derived as follows.

1. Analyze operations support systems(OSS) in a company
2. Decompose eTOM level 3 processes and compare them with the results of step 1
3. Generalize OSS functions
4. Investigate and compose steps 2 and 3 results
5. Derive eTOM level 3 standard recommendation functions

The following Table 1 and 2 are examples of standard recommended functions.

TABLE 1: S.R.F for Level 3 eTOM Processes in Customer Interface Management

Level2 Process	Level3 Process	Required	S.R.F
Customer Interface management	Manage Contact	M	Manage all contact of potential or existing customers
		O	Develop and supplement contact mgmt.
	Manage Request (Including Self Service)	M	Receive potential or existing customer requests.
		M	Manage the status of the request.
	Analyze and Report on Customer	M	Analyze closed requests and customer contacts.
		M	Generate reports on closed requests and customer contacts.
	Mediate & Orchestrate Customer Interactions	M	Define interoperation format between the enterprise and its customer
		M	Transform customers' interoperation data to the enterprise format

In eTOM level 2 Customer Interface Management is responsible for managing all interfaces between the enterprise and potential and existing customers [9]. Customer Interface Management process is decomposed into four level 3 processes in Table 1. In Table 1, the required column indicates that standard recommended functions (S.R.F) are mandatory (M) or optional (O). S.R.F column explains each function of level 3 process in Customer Interface Management process.

Similar to Customer Interface Management, we derive the standard recommended functions of Service Configuration & Activation business process as in Table 2.

Actually, Service Configuration & Activation business process has nine level 3 processes including Design Solution, Implement, Configure & Activate Service, Report Service Provision, Close Service Order, Recover Service and level 3 business processes in Table 2. Just as the example of the standard recommended functions, the Table 2 explains four level 3 business processes.

TABLE 2: Part of S.R.F for Level 3 eTOM Processes in Service Configuration & Activation

Level2 Process	Level3 Process	Required	S.R.F
Service Configuration & Activation	Allocate Specific Service Parameters to Services	M	Determine the availability of the requested service parameters.
		M	Reserve or release service parameters.
		M	Allocate the specific service parameters.
	Track & Manage Service Provisioning	M	Monitor the status of service orders.
		M	View/Modify service orders and add additional information.
		M	Cancel a service order.
		M	Schedule, assign and coordinate service provisioning related activities.
		M	Distribute service orders.
		M	Initiate requests of resource orders.
	Issue Service Orders	M	Assess the requests of service orders and feasibility.
		M	Receive service orders.
		M	Issue service orders
	Test Service End-to-End	M	Test specific services.

Based on the standard recommended functions of the level 3 processes of the Fulfillment process we can derive the following process flow diagram. The figure 4 indicates how the level 3 processes in Service Configuration & Activation process interact. This process flow diagram helps understand the relations among the processes and is the very important tool to automate Service Configuration & Activation process. Like the process flow diagram in the Figure 4, we can derive other process flow diagrams for other level 2 business processes in Fulfillment to help automate each business process. These process flow diagrams are just references so that we can create different process flow diagrams for the same level 2 business process in Fulfillment.

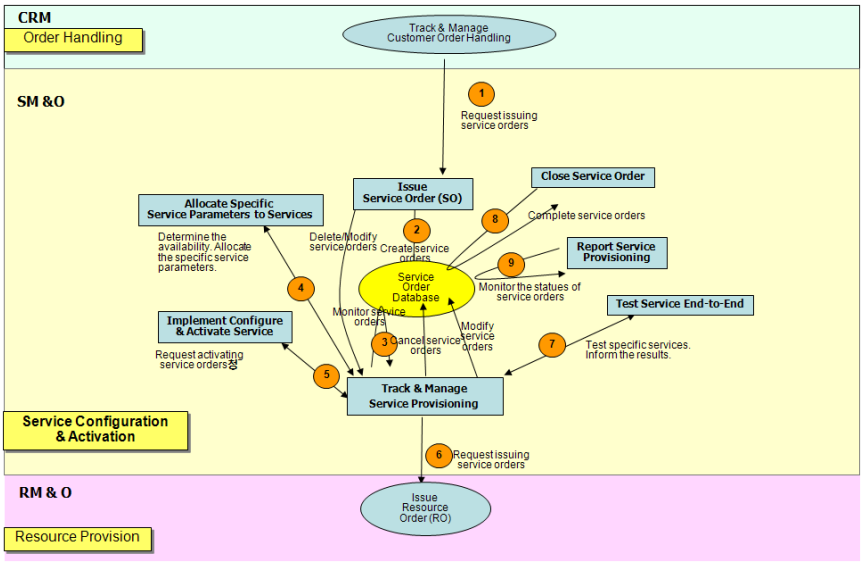

Fig. 4. Service Configuration & Activation Process Flow Diagram

The following shows the flow of the Figure 4.

Flow of the Figure 4

1. Track & Manage Customer Order Handling process in CRM layer request issuing service orders.
2. Issue Service Order process in SM&O (Service Management & Operations) layer creates service orders.
3. Track & Manage Service Provisioning process in SM&O determines the availability of service orders and then request activating specific services.
4. Track & Manage Service Provisioning process in SM&O requests issuing resource orders.
5. Track & Manage Service Provisioning process in SM&O requests testing specific services and receives the results.
6. Close Service Order process in SM&O completes service orders and reports.

3.2. Operations Support and Readiness Business Process Analysis

In this subsection, we focus on analysis on OSR process. OSR process is responsible for providing management, logistics and administrative support to the FAB business processes and for ensuring operational readiness in the fulfillment, assurance and billing areas [9]. A clear example of this type of processes is the staffing capacity management processes which are used to ensure efficient operation of call centers [6]. The Figure 5 shows level 2 eTOM business processes in OSR process. OSR process consists of CRM Support & Readiness, SM&O Support & Readiness, RM & O Support & Readiness, Manage Workforce, S/PRM Support & Readiness.

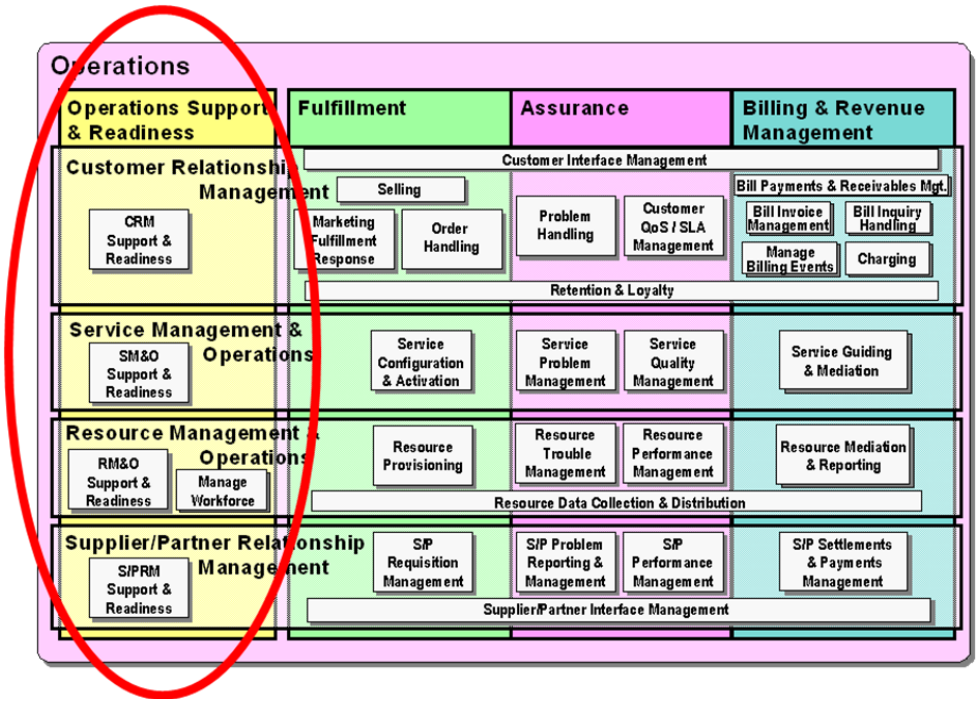

Fig. 5. Level 2 Business Processes in Operations Support & Readiness

According to the naming rule of level 2 eTOM business process in [8], the name of the level 2 business processes should noun. However, we can see that Manage Workforce has the form of verb plus noun. This is because originally Manage Workforce process is level 3 eTOM process. Since Manage Workforce is very important business process for telecom companies, it now becomes the level 2 process. We will show why this process is important with an example in the next section.

As with the same procedure in subsection 3.1 we can derive standard recommended functions for the level 3 processes. As examples, we show standard recommended functions for CRM Support & Readiness and SM&O Support & Readiness in Tables 3 and 4, respectively.

TABLE 3: Part of S.R.F for Level 3 eTOM Processes in CRM Support & Readiness

Level2 Process	Level3 Process	Required	S.R.F
CRM Support & Readiness	Support Customer Interface Management	M	Develop and update customer interface.
		M	Analyze trend on customer contacts.
	Support Order Handling	M	Establish and monitor new or modified infra. for customer order handling.
		M	Monitor customer order handling infra. shortfall.
		M	Report on the capability of the customer order handling infra. deployment processes.
		M	Analyze trend on order handling.
		O	Forecast resource requirements for customer order handling.
		O	Develop/deploy/modify the support tools for customer order handling Infra. deployment.
	Support Problem Handling	M	Manage schedule of extracting customer product performance data to support the analysis activity. Request performance test.
		M	Request customer provisioning to solve customer problem.
		M	Monitor and track problem handling process and the related cost.
	Support Marketing Fulfillment	M	Support marketing fulfillment response process.
		M	Monitor product launch planning and marketing fulfillment activity
		M	Redistribute resource or enable new capability.
		M	Analyze marketing trend.

In Table 3, we explain S.R.Fs for four eTOM level 3 processes in CRM Support & Readiness. In addition to these processes, CRM Support & Readiness also includes nine more business processes such as Support Retention & Loyalty, Support Selling, Support Customer QoS/SLA, Manage Campaign, and etc [9]. The main goal of CRM Support & Readiness is to ensure that the support capability is in place to allow the CRM FAB processes to operate effectively [9]. Similarly, in Table 4, we explain S.R.Fs for three eTOM level 3 processes in SM&O Support & Readiness. Additionally, SM&O Support & Readiness includes one more eTOM level 3 process, Manage Service Inventory. The main goal of SM&O Support & Readiness is to ensure that the appropriate service capacity is available and ready to support the SM&O FAB processes [9].

4. Process Evaluation and Workforce Management Optimization

In this section we show how to evaluate performance of a new developed process, Order Handling, of Fulfillment in a company. The new order handling process is obtained after comparing standard functions in section 3 with the company's current business processes. For the performance evaluation technique we use the simulation technique.

TABLE 4: Part of S.R.F for Level 3 eTOM Processes in SM&O Support & Readiness

Level2 Process	Level3 Process	Required	S.R.F
SM&O Support & Readiness	Enable Service Configuration & Activation	M	Detect service infra. operational limitations and deployment incompatibilities.
		M	Deploy service infra. mgmt. rules.
		M	Test and accept new or modified service Infra.
		M	Analyze capacity utilization of service infra. statistically.
		M	Track, monitor and report on service infra. deployment processes and costs.
		M	Recover and remove obsolete or unviable service infra.
		M	Rearrange service infra.
	Support Service Problem Management	M	Manage service Infra. and service instance
		M	Analyze historical and current service instance problem and performance statistics.
		M	Manage service problem handling process and cost
		O	Manage service problem notification facilities
	Enable Service Quality Management	M	Control, plan, and manage service quality in emergency situation.
		M	Monitor regimes of service infra. to ensure performance within agreed parameters.
		M	Establish, maintain and managing the testing of service quality control plans.
		M	Produce service quality statistics.
		M	Track and monitor service quality mgmt. processes and associated costs.
		M	Analyze and monitor service instance analysis activities.

For an example of performance evaluation with simulation in network operations and management area, refer to [10]. As another performance evaluation technique we consider mathematical programming or optimization technique for Manage Workforce process that was mentioned in subsection 3.2. Manage Workforce becomes the very important business process because it is one of key survival factors for telecom companies [11].

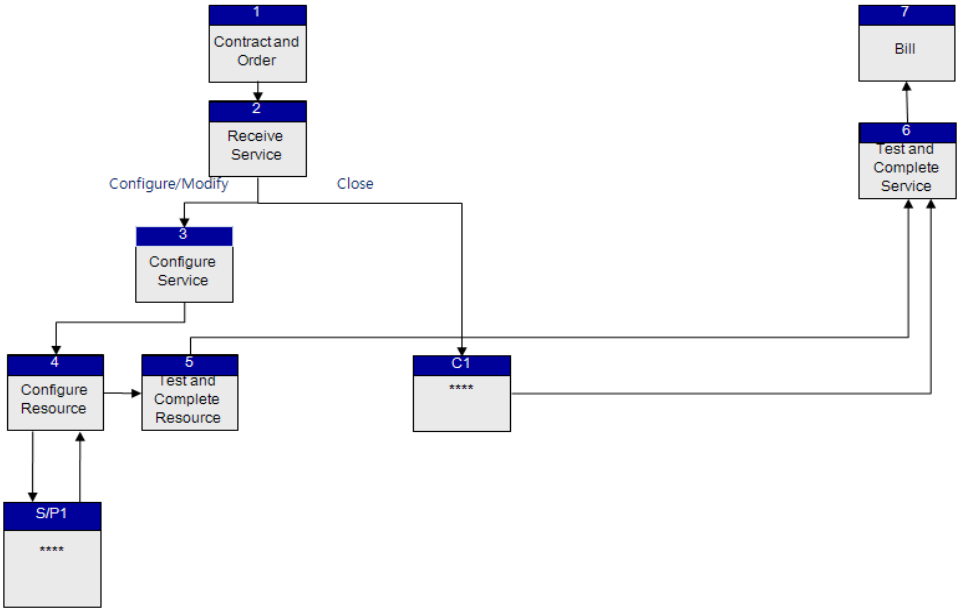

Fig. 6. The order handling business process flow

Let us start with the new developed order handling business process of the Figure 6. The Figure 6 has three branches of flow. The first branch is from node 1 to node 7 with Configure and Modify in Figure 6. This branch is for service configuration. Service close process is

from node 1 to C1 to node 7. The third branch goes through node S/P1 that process use suppliers or partners supports. For performance analysis purpose we focus on the first branch.

In the first branch, we have seven nodes or business processes. These nodes can have sub processes such that Configure Service node may consist of collaborating service configuration, writing work schedule, and configuring service. However, for performance analysis purpose, we just consider 7 business processes and for the sub processes, we consider them as black boxes. In addition, for easy performance analysis, we have four processes in the simulation model in Figure 7. From node 3 to node 6, they become one node called Configure and Complete Service.

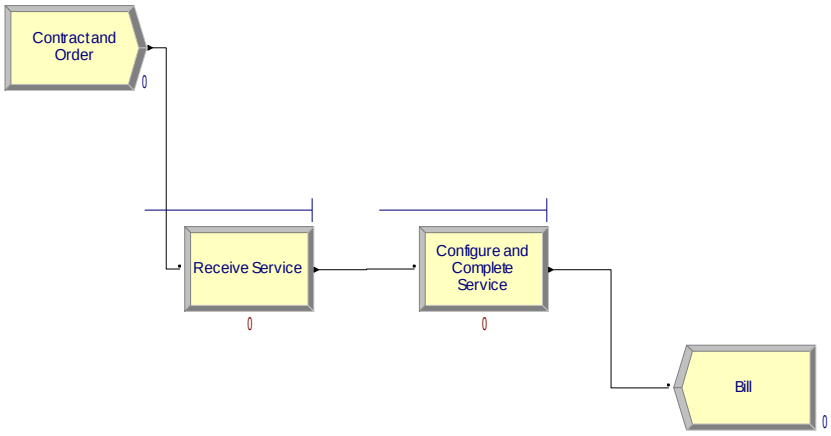

Fig. 7. Simulation example for order handling process

The simulation model is modeled by Arena software package version 13 [12]. To use simulation for performance analysis, we have to select measures to evaluate the process. In this example we use average time in the process and average waiting time in queues with replication number 30. For interarrival process we use exponential distribution with mean 1/3 hours. For service time distribution, Receive Service uses triangular distribution with minimum 0.05, mode 0.083, and maximum 0.166 hours. Configure and Complete Service uses triangular distribution with minimum 0.5, mode 4, and maximum 8 hours. The Table 5 shows the results of the simulation model in Figure 7.

TABLE 5: Simulation Results of Order Handling Process (unit: hours)

Measure	Average	Half Width	Min	Max
Total Time	4.9275	0.43	1.8348	7.6653
Wait Time	0.8201	0.35	0.00	4.5477
Value Added Time	4.1074	0.49	1.5144	7.4162
Wait Time in RS	0.0211	0.01	0.00	0.2724
Wait Time in CCS	2.6380	0.29	0.00	7.4024

In Table 5, total time is the time an arbitrary order spends in the process. Half width means 95% confidence interval half width. Value added time is from total time minus wait time. In addition, we can compare wait time in Receive Service (RS) and that in Configure and Complete Service (CSS) in Table 5.

As another performance evaluation technique we consider mathematical programming or optimization technique for Manage Workforce process. The goal of Manage Workforce is to manage the staff performing manual activities along with managing the actual activity being performed [9]. Therefore, it is necessary to know how to minimize daily cost in Manage Workforce and if the mathematical model for the daily cost is constructed then we can check if the current operations policy is optimal or not. Related research to the optimal staffing level, refer to [11]. In the example of this paper we apply LP and IP to minimize the daily cost meeting the required number of operations personnel in network operations and management centers in a telecommunication company. The example is modified from [13] to apply to network operations and management centers. The situation is as follows

During each 6-hour period of the day, the K network provider needs at least the number of operations staffs shown in the following table.

Time Period	Number of Operations Staff Required
12 A.M.—6A.M.	8
6 A.M.—12 P.M.	12
12 P.M.—6 P.M.	16
6P.M.—12A.M.	10

Operations staffs can be hired to work either 12 consecutive hours or 18 consecutive hours. Operations staffs are paid $10 per hour for each of the first 12 hours a day they work and are paid $13 per hour for each of the next 6 hours they work in a day. Minimize the cost of meeting K network provider's daily operations staffs' requirements.

To make a mathematical model, we decide decision variables as

Xi: number of operations staffs starting a work at time i period and continuously working for 12 hours. Yi: number of operations staffs starting a work at time i period and continuously working for 18 hours. Here i=1, 2, 3, 4, and i=1 means 12 A.M. -- 6 A.M., i=2 means 6 A.M. – 12 P.M. and so on. Then the mathematical model is as follows.

$$Min\ Z = 120(X1 + X2 + X3 + X4) + 198(Y1 + Y2 + Y3 + Y4)$$

s.t.

$$X1 + X4 + Y1 + Y3 + Y4 \geq 8$$
$$X1 + X2 + Y1 + Y2 + Y4 \geq 12$$
$$X2 + X3 + Y1 + Y2 + Y3 \geq 16$$
$$X3 + X4 + Y2 + Y3 + Y4 \geq 10$$
$$All\ Xi,\ Yi\ \geq 0$$

The above mathematical model is a typical form of LP. In addition, if the decision variable can take on only integer variables, then the model is IP. The solution of LP is

X2=10, X3=4, X4=6, Y1=2, and other variables are 0. Then the total cost = 2,796($). Since the decision variables take only on integer values the solution of IP is same as that of LP in this example. This example can be used as a prototype of minimizing the daily cost in

operations and management centers. For more complex real situation, we can modify the above example.

5. Conclusions

In this paper we considered BPM of Fulfillment and OSR processes for telecom companies. First, in section 2, we reviewed the concepts of business process and BPM and introduced eTOM business process framework. Then, Fulfillment and OSR processes were analyzed in terms of level 3 eTOM processes. With the procedure of deriving standard recommended functions, Customer Interface Management, Service Configuration & Activation, CRM Support & Readiness, SM&O Support & Readiness were analyzed and the standard recommended functions were derived for theses processes. Specially, for Service Configuration & Activation, the business process flow diagram was explained. The business process flow diagrams help understand the relations among business processes and are the very important tool to automate business processes of eTOM level 3. To evaluate business processes, we introduced simulation and optimization techniques. In industry standard associations such as TMForum and ITU-T they do not provide how to evaluate business processes. They just give business process frameworks. Even though the process frameworks in industry standard associations are very useful tools many telecom companies are worry about adopting the process framework. Therefore, if telecom companies know how to evaluate their new processes or that their current processes are optimal or not, they become to have powerful weapons in the fierce competitive business situation. The simulation and optimization techniques are strongly recommend to evaluate their business process.

For the future research, more real case studies using business process management are recommend and the application of process evaluation techniques are expected.

References

[1] B.-Y. Chang, H.-S. Kim, S.-J. Ko and James W. Hong, “A study on service problem management and resource trouble management on a telecommunication network”, LNCS 4773, Springer, 2007.

[2] B.-Y. Chang, B. J. Park and S. J. Hwang, “Design and implementation of a real time process management system for telecom operations and management", Journal of Intelligence and Information Systems, vol. 15, no. 3, Sep., 2009.

[3] R. Anupindi, S. Chopra, S. D. Deshmukh, J. A. V. Mieghem and E. Zemel, “Managing Business Process Flows”, 2nd ed., Prentice Hall, 2006.

[4] P. Harmon, “Business Process Change”, 2nd ed., Morgan Kaufmann, 2007.

[5] S. K. Aytulun and A. F. Guneri, “Business process modeling with stochastic networks”, International Journal of Production Research, vol. 46, no. 10, May, 2008.

[6] TM Forum: Enhanced Telecom Operations Map (eTOM). GB 921CP, Release 9.0, 2010.

[7] TM Forum: Enhanced Telecom Operations Map (eTOM). GB 921P, Release 8.1, 2010.

[8] TM Forum: Enhanced Telecom Operations Map (eTOM). GB 921U, Release 8.1, 2010.

[9] TM Forum: Enhanced Telecom Operations Map (eTOM). GB 921D, Release 9.0, 2010.

[10] B.-Y. Chang, J. W. Hong and B.-D. Chung, “Analysis of network operation management processes", KNOM Review, vol. 11, no. 1, 2008.

[11] S.-H. Seok, B. Chung, B. Park and B.-Y. Chang, “Optimal staffing level of network operations and management centers”, Cyber Journals: Multidisciplinary Journals in Science and Technology, JSAT, Jan., 2011.

[12] W. D. Kelton, R. P. Sadowski and D. T. Sturrock, Simulation with Arena, 4th ed., McGraw-Hill, 2007.

[13] F. S. Hillier and G. J. Lieberman, Introduction to Operations Research, 9th ed., New York: McGRAW-Hill , 2010.

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