Analysis Supporting Tools for Developing Business Continuity Plans

Kenji Ono[1], Felipe Caselli Benevente[2], and Yasuhiro Akakura[3]

[1] Disaster Prevention Research Institute, Kyoto University, Japan
[2]Facultad de Ingenieria, Universidad de Valparaiso, Chile
[3]National Institute for Land and Infrastructure Management, Ministry of Land Infrastructure, Transport and Tourism, Japan

Corresponding e-mail: ono.keni.5z@Kyto-u.ac.jp

Abstract

Preparing BCPs under the Basic law for increasing national resiliency enacted on December 4, 2013 is a new challenge for major ports in Japan. In this regard, ISO22301 requires BCP builders to undertake comprehensive and sophisticated risk analysis and appraisal procedures included in a business impact analysis and risk assessment, for which Japanese port experts are seeking proper procedure, methodologies, techniques and tools. This study discusses on the possible development of analysis aid tool for assisting port experts in undertaking systemic analysis of port business activities, reviewing operation resources and identifying bottlenecks of resource mobilization at disaster areas.

Keywords: business continuity plan, business impact analysis, computer aided engineering, port logistics

1. Introduction

Resiliency of logistics infrastructures such as ports is one of key elements for the modern industry and business activities, therefore for the local, regional and global economy. Developing business continuity plans (BCPs) for major port operations are, in this context, currently encouraged by the government of Japan, in particular aftermath of the Great East Japan Earthquake. Preparing BCPs for ports is not straightforward, however, for people from the port community, which are normally a multi-stakeholder business colony with different business interests and no single governance. The complicated risk analysis and appraisal procedures required by ISO22301 are also other challenges.

This study discusses and proposes a methodology, by focusing on the port logistics, for systematically preparing BCPs under supports of computer aided human and machine interactive working environment. Particular emphasis is placed on the practice to undertake business impact analysis (BIA) for improving quality of the business continuity strategy.

2. Business continuity management system for port logistics in Japan

2.1 Impact of the Great East Japan Earthquake

In the Great East Japan Earthquake and Tsunami Disaster, March 11, 2011, various types of damage including failures of breakwaters and quay walls, liquefaction at the apron, burial on access channel and turning basin due to the tsunami debris including vehicles and containers, were observed in pacific side ports of eastern Japan. Right after withdrawal of the tsunami warnings/advisories in these areas, water area cleaning activities were promptly undertaken by Ministry of Land Infrastructure, Transport and Tourism (MLIT), and prefectural governments. As the results of these efforts, some of quays became temporarily available for ship calls in the major ports until the end of March, 2011.

It took, however, more time to resume the full scale operations in the ports. For example, 3 months was needed to re-open the berth No.1, and a half year was necessary before the container cranes were operational, in Takasago-container terminal in Sendai-Shiogama Port. This fact suggests that the Takasago-container terminal could not properly respond to the cargo handling demand of the region. It was reported that the majority of Tohoku cargos were diverted to the ports in Tokyo Bay area or ports on the Sea of Japan, resulting in much more transportation costs incurred by Tohoku cargo owners. It also disrupted the supply chain for various companies, and enlarged the damage to Japanese economy.

Based on the above experience, MLIT launched in June, 2012 a new policy development for improving earthquakes and tsunami countermeasures for port facilities, which includes the following two items:

(1) Preparing and implementing port-BCP under the mutual cooperation of port community for enabling effective and prompt restoration of cargo transportation functions of the port in the limited human/material resource conditions.

(2) Mutual back-up framework of port function to be developed and included in the port-BCP. [1]

2.2 Outline of the Port-BCP

BCP is a plan of actions, to be prepared in advance, for the purpose of securing continuous existence of the entity of making the plan, not only to prepare the initial response such as secure of the employee or prevention of secondary disaster, but also to enable the entity to continue or restore within the shortest period of important activity of the subject. [2]

In 1995, the function of Kobe Port was completely suspended by the earthquake occurred at just beneath the port. The restoration of the Kobe Port took a long time, during which, although other ports such as Osaka Port provided alternative services, most of the transship container cargos of Kobe Port shifted to Busan Port. These shifted cargos did not come back to Kobe Port even after the complete restoration of the port.

Considering the experience referred above, the purpose of preparing port-BCPs may be summarize as an anchoring of users to the port by restoring port function to the targeted service level within the certain period. In this view, i) toughening port structures such as seismic retrofitting, ii) accelerating rehabilitation works of the port facilities by preparation in advance of damage investigation, rehabilitation design and civil works, and iii) ensuring substitute logistics services in alternative ports, are needed considerations for preparing port-BCPs.

Figure 1 shows the relationship between demand and handling capacity of port cargos in port-BCPs. Right after the outbreak of the disaster, handling capacity in ports may not be enough, however, toughening works and/or accelerating rehabilitating process will help the port to maintain some of port services if necessary proactive actions were taken under the port-BCP. When the cargo handling capacity is still insufficient to stop the gap between demand and supply, alternative port service provider is to be sought for maintaining continuity of the logistics.

The process to prepare port-BCP is as shown in Figure 2. As the demand side approach, Business Impact Analysis (BIA) is utilized to determine maximum tolerable period of downtime (MTPD) and recovery time objective / recovery level objective (RTO/RLO). As the supply side approach, risk assessment (RA) is mobilized to evaluate predicted recovery time / predicted recovery level (PRT/PRL). RTO/RLO and PRT/PRL shall be compared, and when RTO is longer than the PRT with PRL meeting the requirement of RLO, preparations of the port-BCPs are completed.

RA in the context of BCP preparation estimates damages of port facilities and their consequences for eventually evaluating PRT/PRL as the important output from the analysis. [3]

Resources to be considered in the port-BCP include variety of facilities, equipment, human resource, system. Typical resources needed for port operations includes quay walls and piers, access channel, breakwaters, cranes and other cargo handling equipment, and port access road.

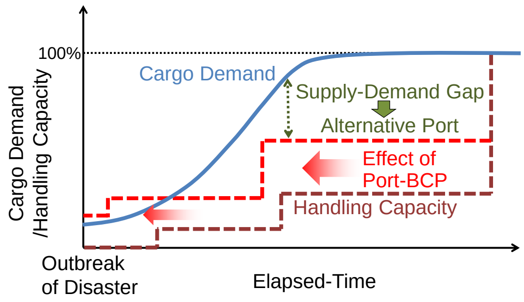


Figure 1. Conceptual Diagram of Port-BCP.

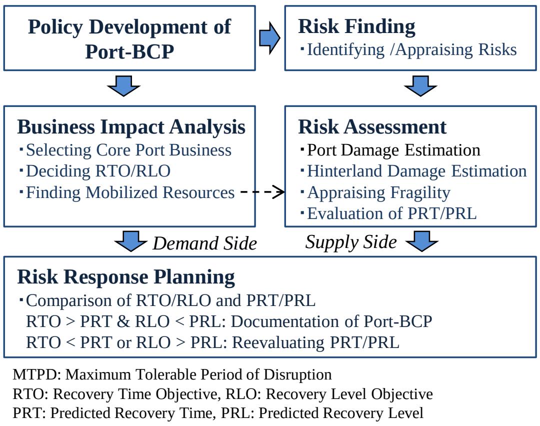


Figure 2. Procedures for Preparing Port-BCP.

2.3 Analysis techniques for preparing BCP

This section introduces some particular techniques, by focusing on BIA, to be considered when port community tackles to the BCP preparation. These techniques may be used by following a systematic procedure to diminish excessive dependency on personal capacity and judgment, and to achieve transparency and traceability for later review and update.

2.3.1 Core business and business flow analysis

The screening of major port business for identifying the core business is a starting point of BIA. Once selected as core businesses, its business flow is to be analyzed for identifying necessary operational resources of the port logistics activities. Securing business resources are one of essential considerations for properly maintaining port business continuity.

In view of this, it is helpful for staff in charge of building port-BCP to employ a business flow analysis based on the IDEF0 method. The business flow analysis is a technique that use diagrams to breakdown the business process structure.

IDEF0 method may be an indicative tool for identifying the detail structures of business operations and resources mobilization. The IDEF0 method is originally a function modeling methodology designed for identifying decisions, actions, and activities included in an organizational function or social/information system. Komatsu et al (2013) introduced "job cards" for developing

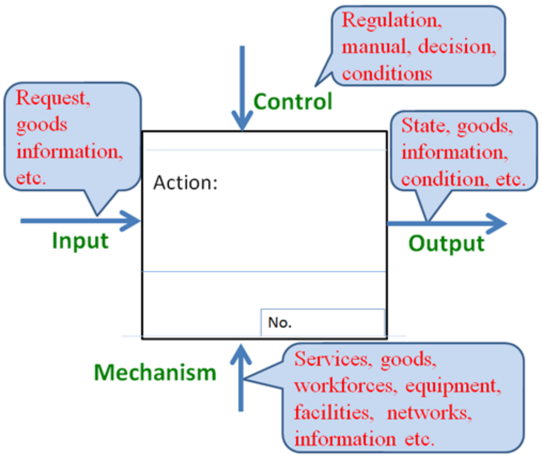


Figure 3 Modified job card for Port BCP preparation

business flow diagram of water treatment plant in Osaka, Japan. [4] An examples of business flow diagram and a template of job card modified by the authors for port BCP preparation are illustrated in Figure 3 and Figure 4.
A business flow diagram is described as an event chain system, where the job card helps identify: i) necessary operational steps, and ii) essential resources, for properly implementing the port core business. For this analysis there are two inputs to be considered in each job card: ie. "mechanism" from below and "control" from the top, as shown Figure 4. The mechanism includes resources directly needed for processing the step, and control represents necessary information for processing it such as permission, notification, policy, guidelines, program, and any other regulations and conditions of concern.
As a result of the business modeling it should be obtained a complete description of the core business, including the direct resources needed. The following task is to identify the dependency among resources, for which the use of the worksheet system presented below is recommended.

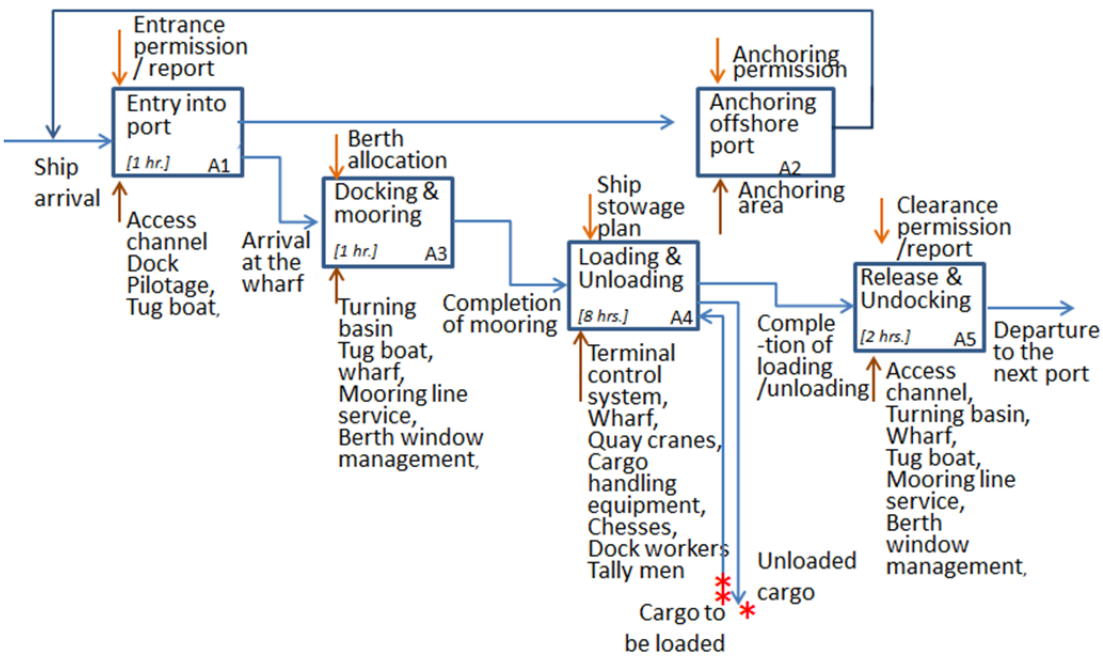


Figure 4 An example of business flow diagram of port terminal operation

2.3.2 Worksheet system

Intensive discussions are needed for deciding port core business as well as identifying important resources for operating core business; both are most important part of BIA implementation, because the disaster in the context of business operation, always means the loss or lack of resources such as facilities, equipment, materials, information, and human and financial resources, for which BIA assist in finding bottlenecks for continuing core business operations. Data processing procedures for removing duplicated resources, classifying them into the typical resource categories and discovering their mutual dependency relationships are due course of BIA to find bottleneck or critical resources in an effective manner. The authors propose a worksheet system as one of effective tools to address this resource analysis and evaluation of the port core business as well as selecting port core business and estimating maximum tolerance of the port clients as also included in the BIA operations. [5]

The work flow diagram provides information about what kind of resources are needed for implementing each step of the port's core business. The “mechanisms” indicates direct resources needed, and from the “controls” information, resources required for providing such controls are to be found.

Opera -tions		Control	Executing agency	Resources	
				Resource for control	Resource for activity
A1	Entry in port	Customs clearance, Entry permission,	Customs, Harbor master, Port	CIQ officers/offices, Harbor master officer, Port MIS, SeaNACCS, Harbor master office,…	Access channel, Tug boat, Pilot, Port radio, Electric/water/fuel supplies, Telecommunication service,
A2	Mooring	Anchoring permission	Harbor master	Harbor master officer, Telecommunication	Anchoring area, Service vessels
A	Docking	Berth	Terminal	Terminal operator staff,	Turning basin, Quay wall, Tug boat, Line men, Port

Figure 5 Identifying resources from business flow diagram

Opera -tions		Resources for control and operations				
		Outside supply	Human resource	Facilities /equipment	ITC systems	Buildings /offices
A1	Entry in port	Electric/fuel/ water supplies	CIQ officers/ offices, Pilot,	Access channel, Tug	Port MIS, SeaNACCS,…	CIQ offices, Harbor building,
A2	Mooring	Water supply	Harbor master officer	Anchoring area	Telecommunication service	
A3	Docking &	Electric/fuel/	Line men	Quay wall, Turning	Terminal operation system	Terminal operation station

Figure 6 Worksheet for classifying resources

Once the resources were identified through business flow analysis, worksheets such as the Figures 5 and 6 assist in processing resources on “step by step basis” for discovering critical or bottleneck resources to maintain and quickly recover core business operations.

2.4 Issues on the practical view point

As discussed in the above section, BIA based on the worksheet system is rich in transparency, which facilitates the information sharing among the port administration and business entities, and encourages participation in the business continuity management activities including preparing BCP of the port.

On the other hand, the step-by-step work procedure and multi-layered structure of the worksheets system leads to the excessive working load on the staff in charge of BIA, therefore resulting in the insufficient analysis. The authors developed a BIA worksheet system for port BCP and noted that the system included 14 worksheets therefore only transcribing data from the sheet to sheet may impose burden works on the BCP staff. Table 1 demonstrates a list of identified operational resources of a container terminal, which were obtained from the workflow analysis of the terminal and added up to 61. Authors

Table 1 List of identified operational resources of a container terminal

Resources for control and operations				
Outside supply	Human resource	Facilities /equipment	ITC systems	Buildings /offices
Electric/fuel/water supplies, Telecommunication service (5 items)	CIQ officers, Port authority staff, Harbor master officer, Pilot, Line men, Stevedore's staff, Dock workers, Crane operator, Yard planner, track driver, RTG operator, Gate clark,… (18 items)	Access chainnel, Anchorage, Turning basin, Quay wall, Tug boat, Service vessel, Epron, Quay crane, Trailer/Chesse, RTG, Container slot, Reefer concent, Gate, Access road, CIQ inspection equipments,… (24 items)	SeaNACCS, Port MIS (Management Iinformation system), Port radio, Terminal operatin system, Port security system (5 items)	Harbor building, Port authority office, Harbor master office, Harbor traffic control office, Shipping agent office, Terminal operation station, Stevedore's site office, Marine house (9 items)

consider it impossible to process by humans these bulky and duplicative data. As such, developing computer assistance for developing worksheets were considered vital for mobilizing worksheet system to undertake BIA.

3. Computer aided analysis supporting tools

As stated in the above section, the authors proposed a computer aid system for developing BIA work sheets in order to enable port community to undertake BCP preparation in a more efficient and effective manner. The system mobilizes VBA (Visual Basic for applications) embedded in Microsoft Excel sheets, which automatize transcribing, removing duplication, classifying and identifying interdependency of the resources with less working burden on the BCP staff.

The schematic view of the system is as shown in Figure 7. The system comprises three main stream worksheet files: ie. the files of “BIA”, “RA” and “Resource bottleneck evaluation”. Among these mainstream files, BIA file are supported by three data generation files: ie. the files of “Resource collection sheet”, “Resource dependency identification sheet” and “RLO resource mobilization judgement sheet”. These three supporting devices play respectively important roles of: i) collecting resources from the work flow diagram of core port business, ii) identifying interdependency of the resources, and iii) selecting and deciding recovery levels of the resources on order to meet the required RLO of the port clients.

The system also equips learning capacity for remembering the past input data and mobilizing them to develop new worksheets, therefore, BCP staffs are always able to get assistance from computer at any stage of the BIA and RA implementation. The authors consider it important to save the effort for the staff in order to concentrate an analytical thinking for materializing further effective BCP preparations.

Figure 8 demonstrates one of the Excel window views comprises the resource collection sheets, which includes i) checkbox menu for collecting resources based on the workflow diagram, and ii) functions to remove duplication of resources and summarize them into a corresponding cell.

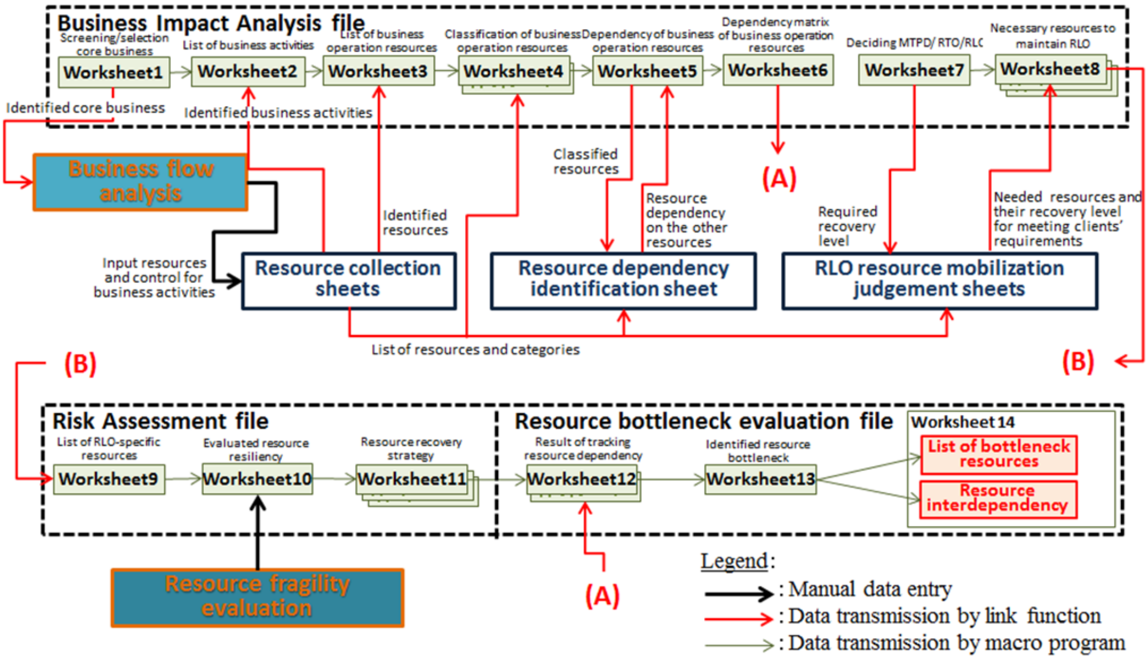


Figure 7 BCP worksheet system assisted by VBA macro programing techniques

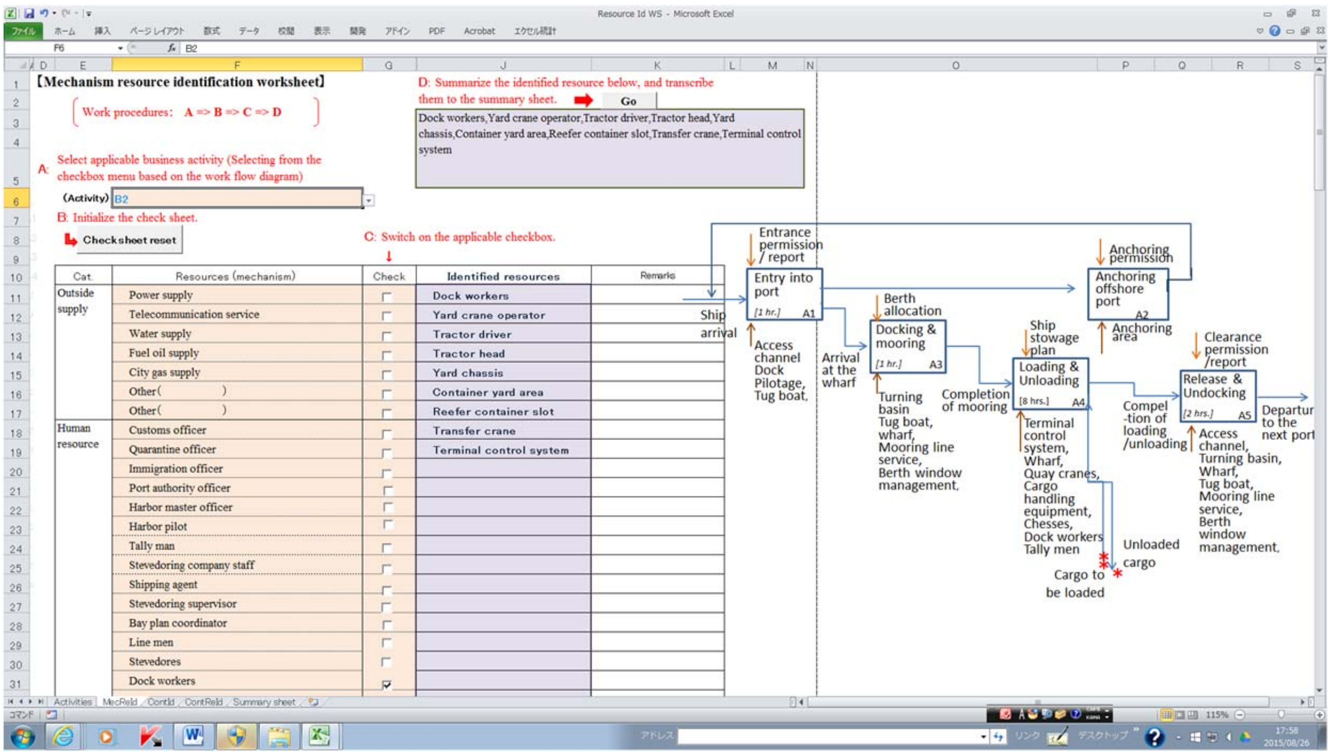


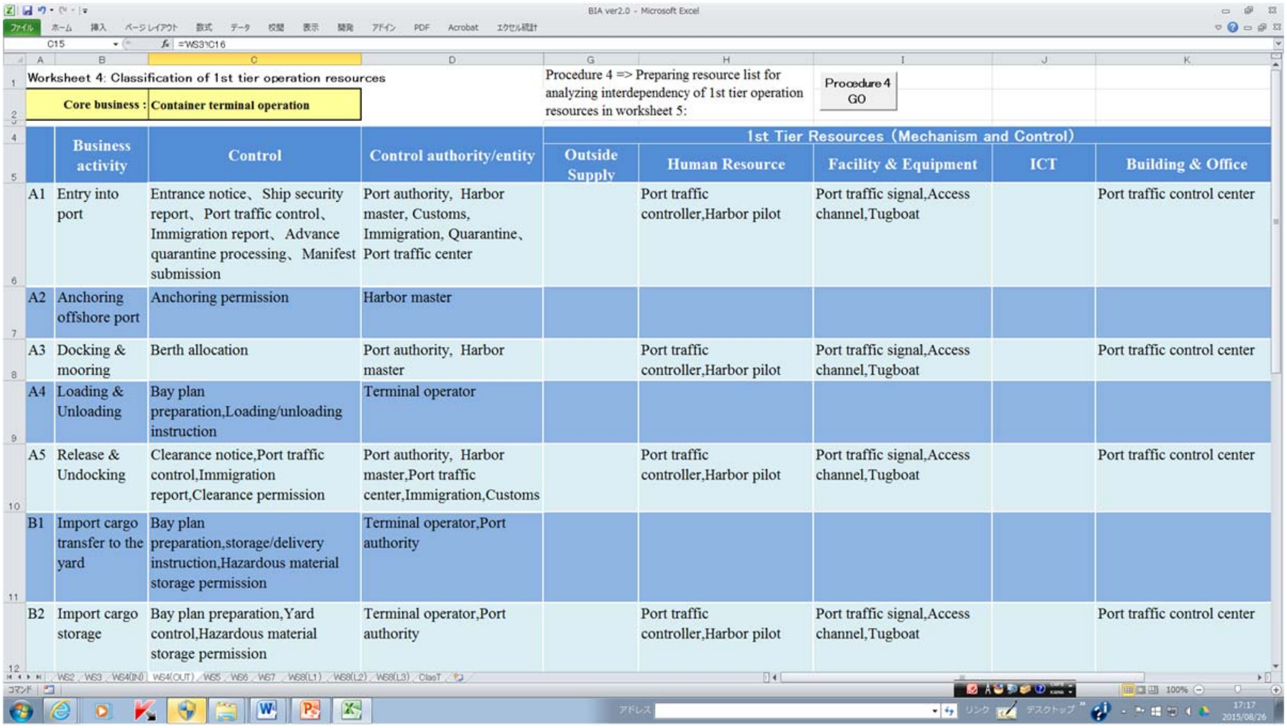
Figure 8 Example of VBA macro supported worksheet (Identifying the mechanism resources)

Names of resources included in the checkbox menu are prepared in advance based on the standard terminology in the area of port operations, therefore, it contributes to remove orthographical variant.

BCP staffs are only requested to switch on the applicable checkbox and to click the macro button. As such the computer aid system enables the staff in charge easily to handle a bulky data obtained from the business flow diagram.

Figure 9 shows a worksheet window for classifying

1st tier operation resources. The identified resources through business flow analysis are classified into five resource categories of i) outside supply, ii) human resource, iii) facility and equipment, iv) ICT and v) building and office. Once the system including relevance data and information is established, only a few minutes is enough to complete the works from collecting data on the business flow diagram to create the resource classification table shown in Figure 8 as worksheet 4. As such, computer aided analysis system for preparing BCP is considered powerful as a simulation tool to seek better strategy of improving port business continuity.



Worksheet 4: Classification of 1st tier operation resources

Core business : Container terminal operation

Procedure 4 => Preparing resource list for analyzing interdependency of 1st tier operation resources in worksheet 5:

Procedure 4 GO

	Business activity	Control	Control authority/entity	1st Tier Resources (Mechanism and Control) Outside Supply	Human Resource	Facility & Equipment	ICT	Building & Office
A1	Entry into port	Entrance notice、Ship security report、Port traffic control、Immigration report、Advance quarantine processing、Manifest submission	Port authority, Harbor master, Customs, Immigration, Quarantine、Port traffic center		Port traffic controller,Harbor pilot	Port traffic signal,Access channel,Tugboat		Port traffic control center
A2	Anchoring offshore port	Anchoring permission	Harbor master					
A3	Docking & mooring	Berth allocation	Port authority, Harbor master		Port traffic controller,Harbor pilot	Port traffic signal,Access channel,Tugboat		Port traffic control center
A4	Loading & Unloading	Bay plan preparation,Loading/unloading instruction	Terminal operator					
A5	Release & Undocking	Clearance notice,Port traffic control,Immigration report,Clearance permission	Port authority, Harbor master,Port traffic center,Immigration,Customs		Port traffic controller,Harbor pilot	Port traffic signal,Access channel,Tugboat		Port traffic control center
B1	Import cargo transfer to the yard	Bay plan preparation,storage/delivery instruction,Hazardous material storage permission	Terminal operator,Port authority					
B2	Import cargo storage	Bay plan preparation,Yard control,Hazardous material storage permission	Terminal operator,Port authority		Port traffic controller,Harbor pilot	Port traffic signal,Access channel,Tugboat		Port traffic control center

Figure 9 Example of VBA macro supported worksheet (Identifying inter-dependency of the operational resources)

4. Conclusions

This paper reviewed on the current situations and issues of port-BCP in Japan. Because of complicated and multi-layered port business structures and multi-governance systems of port community, developing port-BCPs are new challenge for Japanese ports. In view of this, the authors discussed and proposed an analysis aid tool for assisting port experts in undertaking systemic analysis of port business activities, reviewing operation resources and identifying bottlenecks of resource mobilization at disaster areas.

The analysis aid tool shown in this paper includes VBA macro programs embedded in Microsoft Excel sheets, therefore, the authors expect it easy for the user to customize the tool and mobilize it in a variety of analysis scene for preparing BCP.

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