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Abstract	After several disasters, e.g. the South Hyogo prefecture Earthquake, 11 September Attacks, it is aware of importance to have a Business Continuity Plan (BCP) for the disaster. On 2005 the Government of Japan also issued several "guidelines to establish Business Continuity Plan" in order to support each organization to establish BCP. The Oil Gas industry has already assessment methods for evaluation of risk related to natural disaster, fire and explosion, etc. and several countermeasures based on the assessments. However such countermeasures seem nominal and are not implemented pragmatically, since it is various for respective stakeholders to evaluate such countermeasures. For a company, who plans to establish Risk Management and Business Continuity Management, it is also crucial to know cost-effectiveness in addition to the expected result of the countermeasures. This project aims to find and propose accountable evaluation methods of expected result and cost–effectiveness by using system design management method after reviewing the current company's risk assessment and countermeasures to the large –scale earthquake.
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Group 1

Group 1's Theme Proposed by JGC Corporation (Nikki)

Theme 15:

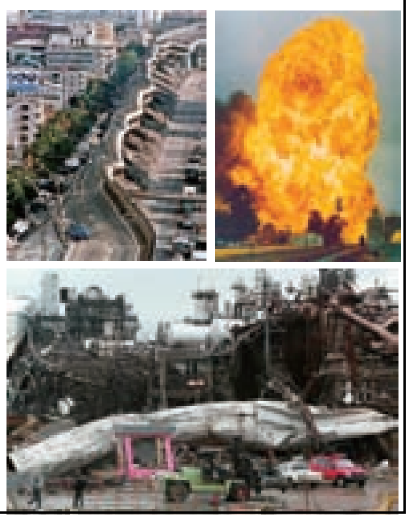
ALPS "safety and security" theme title:

Cost-effectiveness Approach for Risk Management and Business Continuity Management

Proposer Organization's Name : JGC Corporation (Nikki)
Supporter Name and contact info : Akira Wada, Ken Kobayashi

Although assessment methods for evaluation of risks related to natural disaster, fire and explosion, etc. have been well developed in the Oil & Gas industry, countermeasures recommended in the assessments are not implemented straightforward, because it is difficult to know cost-effectiveness of the countermeasures.
For a company, who plans to introduce Business Continuity Management, it is also crucial to know cost-effectiveness of the countermeasures.

This project aims, for example, to develop a system which can easily quantify cost-effectiveness for preparation of Business Continuity Plan for a "Company" .



ALPS Final Report 2010

Group 1

PROJECT TITLE:
"COST EFFECTIVENESS APPROACH FOR RISK MANAGEMENT AND BUSINESS CONTINUITY MANAGEMENT"

Theme:

"Cost-effectiveness Approach for Risk Management and Business Continuity Management"

Proposer Organization: JGC Corporation (Nikki)

Proposer Organization's Supporters: Akira Wada, Ken Kobayashi

Keio Mentor: Taketoshi Hibiya

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ALPS Group1

COST EFFECTIVENESS APPROACH FOR RISK MANAGEMENT AND BUSINESS CONTINUITY MANAGEMENT

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Member Name	**Member Name**	**Member name**
Yasuhiro Taguchi	Kenta Takahashi	Tatsuya Shoji

1. EXECUTIVE SUMMARY

After several disasters, e.g. the South Hyogo prefecture Earthquake, 11 September Attacks, it is aware of importance to have a Business Continuity Plan (BCP) for the disaster. On 2005 the Government of Japan also issued several "guidelines to establish Business Continuity Plan" in order to support each organization to establish BCP.

The Oil & Gas industry has already assessment methods for evaluation of risk related to natural disaster, fire and explosion, etc. and several countermeasures based on the assessments. However such countermeasures seem nominal and are not implemented pragmatically, since it is various for respective stakeholders to evaluate such countermeasures.

For a company, who plans to establish Risk Management and Business Continuity Management, it is also crucial to know cost-effectiveness in addition to the expected result of the countermeasures.

This project aims to find and propose accountable evaluation methods of expected result and cost–effectiveness by using system design management method after reviewing the current company's risk assessment and countermeasures to the large –scale earthquake.

2. TABLE OF CONTENTS

3. PROBLEM STATEMENT

Our client is JGC who is one of worldwide leading engineering companies in the field of Oil & Gas industry.

After an interview of JGC's executive, we knew below

A) JGC's works can be divided into following stages and respective works is done and controlled by each office in charge;

Ref.	Work	Office in charge
1.	Engineering	Head office
2.	Procurement	Head office
3.	Transportation	Head office
4.	Construction with field engineering	Site office
5.	Commissioning &Performance Test	Site office
6.	Guarantee	Site office

B) JGC's most important works is engineering work. The ninety percent (90%) of engineering work are engaged at Head office.

C) In order to build competitive and reliable Plant, engineering work at head office requires repeated real time communication for feedback and feed-forward.

D) Engineering work for project needs a minimum number of engineering from several fields.

E) JGC's most important position for project execution and project management is Project Manager, who has responsibility of Quality, Cost and Delivery(QCD) toward JGC's customer and of budget toward JGC's top management.

F) It takes from 10years to 15years for JGC to bring Project manager up.

G) JGC already has BCPs for Head Office and for each Site office.

H) A BCP for Site office will be prepared based on risk assessment for respective project as a part of Project Execution and Project Management. Then the BCP for Site office is out of this project due to JGC's request.

I) A BCP for Head office already has been prepared based on risk assessment for Head office activity and impacts to overall projects.

J) To find and propose accountable evaluation method for A BCP for Head office is the scope of this project.

K) The Current BCP is prepared based on assumption that the Head office is a large–scale earthquake–resident building which is more than the South Hyogo prefecture Earthquake then also that JGC thinks there is no impact to business continuity.

Based on the above information, we think that there are several problems in current BCP at Head office as follows;

A) Expected recovery time for engineering work is not estimated.

B) Acceptable recovery time for the engineering work is not defined.

C) Target recovery time for engineering work is not defined.

D) Even Project Manager's activity is important for project management and company profit, the protection of his life depends on himself.

E) Lack of scenario analysis of impact to project from earthquake.

F) Evaluation method of Cost–effective is not established.

G) Even the Head office building is robust earthquake-resident building, availabilities of public transportation, engineer, engineer's family and his community are not considered.

4. ANALYSIS AND DISCUSSION OF ALPS METHODS

(Hao-san Parts)

Introduction

When it comes to system design and management, the most popular method to be used is V-Model, which is a systems development model designed to simply the understanding of the complexity associated with developing systems. In our ALPS topic, we use V-Model to define a uniform procedure for our project development---to explore a cost-effectiveness approach for risk management and business continuity management.

The "V" is a process that represents the sequence of steps in our project life cycle development. It describes the activities and results that have to be produced during this process. The left side of our V-Model represents the decomposition of our customer's requirements, and creation of our system specifications. The right side of the V-Model represents integration of parts and verification and validation.

The V-Model provides guidance for the planning and realization. By using V-Model, we can minimize the project risks, improve and guarantee the project quality, reduce the total cost over the entire project and system life cycle, and improve the communication between all stakeholders. It involves early and comprehensive identification of goals; a concept of operations that describes user needs and the operating environment, thorough and testable system requirements, detailed design, implementation, rigorous acceptance testing of the implemented system to ensure it meets the stated requirements, measuring its effectiveness in addressing goals, on-going operation and maintenance, system upgrades over time, and eventual retirement. The process emphasizes requirements-driven design and testing.

The advantage of using V-Model for our project is it provides concrete assistance on how to implement tools and its work steps, defining explicitly the events needed to complete a work step: each activity schema contains instructions, recommendations and detailed explanations of the activity. The Figure 4-1 shows the main tools which could be applied in this model.

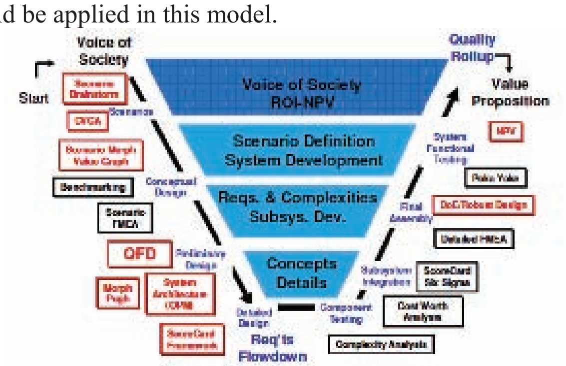


Figure 4-1 ALPS tools used for Vee Model

1. Tools for identifications of voice of society and the project focus

Mind Map

A mind map is a diagram used to represent words, ideas, tasks or other items linked to and arranged around a central key word or idea. Mind map is used to generate, visualize, structure and classify ideas and as an aid to studying and organizing information, solving problems and making decisions (From Wikipedia). By presenting ideas in a radial, graphical, non-linear manner, mind maps encourage a brainstorming approach to planning and organizational tasks. Though the branches of a mind map represent hierarchical tree structures, their radial arrangement disrupts the prioritizing of concepts typically associated with hierarchies presented with more linear visual cues.

In our case, we choose what we want to do (BCP design for JGC) as the central word, surrounded by company history, product history, competition approaches, usage history, potential markets, and project goal and usage scenarios. With every branch, we develop different project scenarios and possible contexts which could be useful in the following problem exploration. Figure 4-2 shows our Mind map in details.

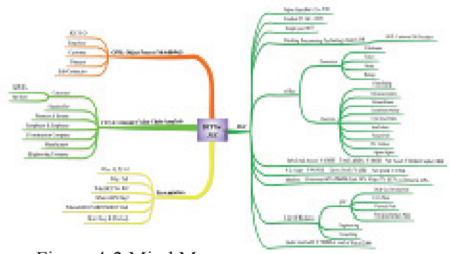


Figure 4-2 Mind Map

CVCA&OPM

Customer Value Chain Analysis (CVCA) is an original methodological too that enables us in the project definition phase to comprehensively identify pertinent stakeholders, their relationship with each other and their role in the project life cycle. By performing CVCA in our ALPS project, we are better able to recognize diverse product requirements and their relative priority when undertaking project definition assessment and using downstream "Design for X" tools. CVCA extends the functionality and utility of the customer chain by requiring us to investigate the value relationships, or value propositions, between the various customers and then evaluate customer needs relative to our corporate strategy using project definition assessment. CVCA enables us to better evaluate the initial business model and isolate the value propositions of individual customers for flow-down to later DFX methodological tools, such as Quality Function Deployment (QFD), and Failure Modes and Effects Analysis (FMEA). By systematically carrying out CVCA, we ensure clarification of the value propositions to develop and better recognize the priority of our customers' needs. We build our CVCA according to our customer's (JGC) requirements step by step:

Step 1. Define the initial business model and assumption

For new projects, it is necessary to have well-formulated knowledge of the strategic objectives of the project. It is often the case that the business models for new projects are inadequately defined by the design organization, and hence are poorly understood by the design team (Wilson 1993). Therefore, before we design our CVCA, we must determine: what is the business model for this project? How will the project be profitable?

Establishing the business model for cost-effectiveness business continuity plan to JGC, for example, we have to answer the questions: who use this BCP plan for what? Who will be the stakeholders that can interact with this project? What kind of BCP plan should be designed according to the real situation? To whom would the end customer complain if there was a problem? Who will do which parts in the project? And so on. In this case, JGC will use BCP plan to protect its business. During this process, banks, manufacturers, construction companies will interact with this project. A BCP plan focusing on cost-effectiveness should be considered carefully this time. If there was a problem, JGC's customers will complain about its work. Construction companies, manufacturers, and other financers will be involved into this project.

Step 2. Delineate the pertinent parties involved with the project

In addition to the end user, important customers may include less obvious stakeholders such as business partners, regulatory bodies. All these stakeholders become customers in the customer value chain. As shown in the Fig, the main customers of this project are not only JGC's customers. The end-users are also the customers.

Step 3. Determine how the parties are related to each other

Based on information from the initial business model, how are customers related to each other and the project? We use arrows to link customers. There are two kinds of flows in the business model: capital flow and products and service flow. The directions of the arrows in the analysis are important as the lines connecting the customers.

Step 4. Identify the relationships among the parties by defining the flows between them

The direction of the relationship arrows now becomes important with the mapping of the value relationships or flows between the customers. The flow items represent the value propositions to each of the individual customers. To determine which types of flows are important, we should ask: what is each customer's main role in the project life cycle? What bearing does this customer have on the success or failure of the project? By analyzing these flows we will be able to focus on specific consumers to delineate their needs and better recognize their relative priority.

The arrows show the direction of the flow accompanied by the appropriate icons. For example, a dollar sign ($) may indicate money whereas a information mark (I) may indicate the messages. (P&S) means product and services.

Step 5. Analyze the resulting customer value chain to determine critical customers and their value propositions

To determine who the customers critical to the success of the project are, trace the payments ($) and products and services mark (P&S) in the chain. The needs of these critical customers must be included in our QFD analysis. To determine the value propositions of the critical customers, look at each customer's input and output flows and consider how they will make profit and receive a return on their investments. The pertinent customers' flows can be use to generate the product's VOCs.

Step 6. Use the CVCA results downstream in the product design process

The CVCA process has thus far captured valuable information about the customers and their needs which can be used in downstream DFX tools. Customers' needs can be directly inputted into QFD analysis, and negative VOCs can provide input for FMEA to generate robust and error-proofed designs. The Object Process Methodology (OPM) shows our information system. It illustrates to what extent the objects can influence each other. Figure 4-3 and Figure 4-4 shows CVCA and OPM for our project.

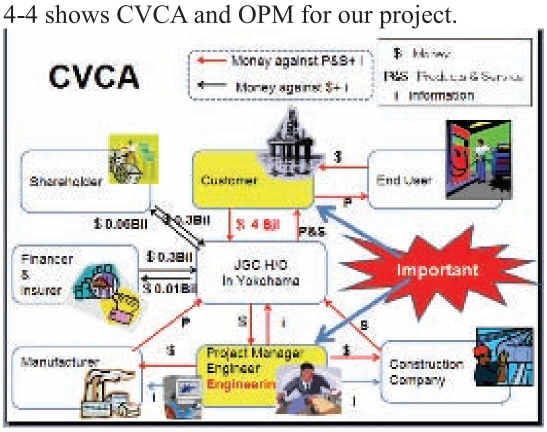


Figure 4-3 CVCA for BCP Plan of

Figure 4-4 OPM for BCP Plan of JGC

Interview, observation

Interview is the most valid and useful method when you want to get your customers' real requirements or the related information. During the process of the interview, the advantage is you can talk face to face with your interviewees. The information you received is direct, without delay. After you get the information, you could have time to think about it deeper. Most of the time, new questions are generated together with the conversation. Therefore, by well-designed interview, lots of valuable information could be gotten from our customers. We should make it clear that the most important function of interview is helping us to get as much as information as we want. It is a tool to help us get closed to our customers' requirement. And then we would have a clear image about our project: what kind of result do our customers really want at last?

Our interviewees are the top managers of JGC, Yokohama: Mr. Yoshimoto, chief engineer of JGC, and Mr. Yamamoto, vice president of Misuho. Mr. Yokohama gives us three main requirements for the BCP plan which they prefer: when serious disaster happens, we have to make sure that the communication, transportation systems are valid. The most important principle is employees' safety and business continuity. Mr. Yamamoto highlight that "every country has different form of management. It is difficult to manage foreign employees. For processing systematic project, we have to understand the local culture. The key point of this project is humans; therefore, we have to collaborate with customers efficiently." We think this is the most important difference between others projects topics: we are designing a "rule" that how to organize people after big disaster to protect their lives and their business. It is not a product but a special service.

From the interview, we also know that one powerful competitor of JGC is Chiyoda Corporation. Both of them have high technology of building natural gas plant and best solution for construction, procurement and engineering regarding to large scale plants. However, Chiyoda Corporation puts emphasis on specific markets. We also know that both of the two companies have BCP plan for themselves but focus on different fields. This time JGC told us that now the most important thing they are caring is the safety of the project managers. This is because JGC have to spend a lot of time and money for the project managers training program. If they lost project managers in the earthquake, they cannot continue their business and then they cannot satisfy their customers' requirements anymore. Therefore, JGC works as our customer, their need is to create a BCP plan at head office in order to minimize and mitigate extra costs when huge disaster happens. And in this plan, the key point is how to protect the project managers and the employees from the disasters.

Why does JGC expect to redesign its BCP plan? There are two reasons: first, the current one is not effective anymore because the structure of JGC has been changed and the previous one cannot work in high efficiency. Second, the investors prefer a sustainable growth of net profit. Therefore, JGC has to make sure that its business cannot be stopped by the earthquake.

After understanding our customer's requirements, we propose three optional solutions: first, building compact city near Yokohama. When project starts, the project managers and their team should move into that city to continue their work. The city have need to be located in a place that there is no or seldom disaster happened before. If there is disaster, the business will not be influenced seriously. Second, continue the business abroad. JGC have closed relationship with lots of abroad companies and customers. Therefore, once the project starts, the project team could move to the local countries to continue their business. Third, associate with affiliated companies. Until now, we have to use other tools to decide which strategy is more cost-effective. Figure 4-5 shows our problem definition by TO-BY-USING method.

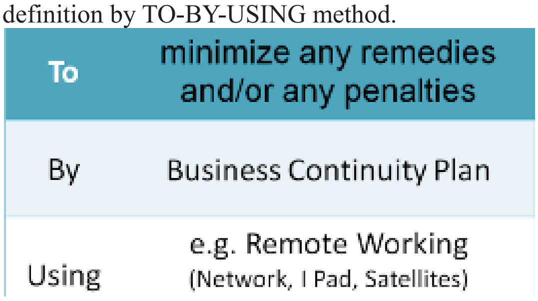


Figure 4-5 Problem definition by TO-BY-USING method

Scenario graph

The scenario graph is a tool for capturing the possible contexts in which a solution is offered. At this stage we use it to make a flexible long-term plan for our project and identify the most critical outcomes by six steps.

Step 1. Decide assumptions for change

The first stage is to exam the results of environmental analysis to determine which are the most important factors that will decide the nature of the future environment within which the organization operates. In any case, the brainstorming which should then take place, to ensure that the list is complete, may unearth more variables- and particular, the combination of factors may suggest yet others.

Step 2. Bring assumptions together into a viable framework

The next step is to link these drivers together to provide a meaningful framework. This may be obvious, where some of the factors are clearly related to each other in one way or another.

Step 3. Produce initial mini-scenarios

The outcome of the previous step is usually between seven and nine logical groupings of factors.

Step 4. Reduce to one or two scenario

The main action, at this stage is to reduce the seven to nice mini-scenarios to one most important one.

After these four steps, we get our final scenario graph which is shown as Figure 4-6.

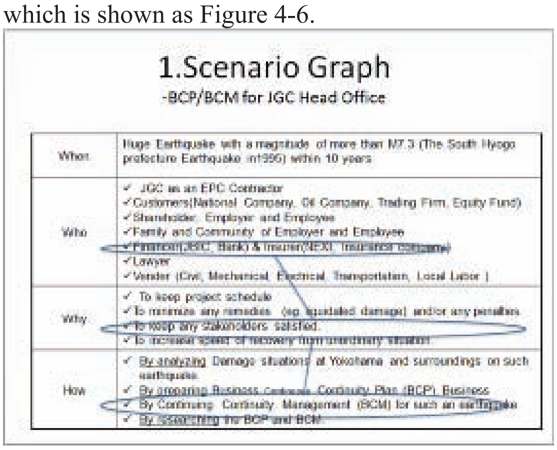


Figure 4-6 Scenario Graph

Scenario prototyping

The prototype is the original image of our project--- a small compact city: Tama. First, with the prototype, we can compare the different environment situation between working in Yokohama head office and working in compact city when earthquake happens. In Yokohama, there are lots of high buildings and public facilities. Once earthquake happens, people can easily be hurt by the destroyed buildings. Comparing with Yokohama, Tama is a small town, with less people and convenient transportation system. There are less serious disasters happens in Tama in the history. Second, during the normal life, the employees can easily arrive at Yokohama head office from Tama by car or by train. It will take them less than two hours. Figure 4-7 shows the distance and the time consuming by different vehicles between Tama and Yokohama. Third, the living cost is less comparing with other cities. Figure 4-8 shows the land type and different living cost between five cities.

Figure 4-7 Distance and time consuming between Tama and Yokohama

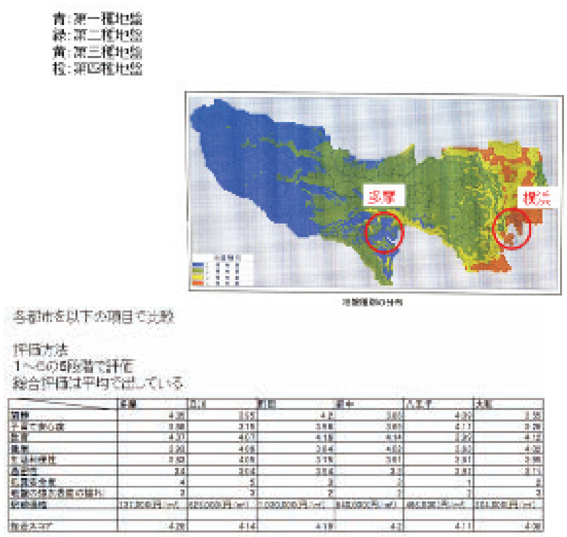


Figure 4-8 Land type and different living cost between five cities

The main operation scenario of our project could be like this: when the compact city in Tama has been completed, a group of project managers and their employees will move into the city to finish their business. The compact city offers them with perfect living and working facilities. Therefore, everything is going well just as scheduled. One day, serious disaster happens, the situation in Yokohama is very bad, lots of employees cannot be in office in time because of the failure of transportation system. However, the project groups which are working in the compact city in Tama are still working as usual without any disruption.

2. Tools for requirements flow down and concept development

QFD

Quality Function Deployment (QFD) is a method to transform user demands into design quality. It helps us transform customer needs, which is the voice of customers, into engineering characteristics. It is a complimentary method for determining how and where priorities are to be assigned in product development. The intent is to employ objective procedures in increasing detail throughout the development of the product. (Reilly, 1999)

The three main goals for our group in implementing QFD are: first, prioritize spoken and unspoken customer (JGC and its employees) wants and needs; second, translate these needs into technical characteristics and specifications; third, build and deliver a quality BCP plan by focusing everybody toward customer satisfaction. We take several steps to develop our QFD house:

Step 1. Customer requirements--- the voice of customers

The first step in a QFD project is to determine what market segment will be analyzed during the process and to identify who the customer are (JGC and its employees). We then gather information from customers on the requirements they have for the BCP project. The requirements we choose is from the interview we took which includes cost effectiveness, project manager's safety, and the schedule and so on which our customer (JGC) cares a lot. Another way to develop the customers' requirement is to use Use Case Analysis. Each use case provides one or more scenarios that convey how the system should interact with the end user or system to achieve our special business goal. Figure 4-9 shows the VOC and USE CASE which are used to analyze customers' requirements.

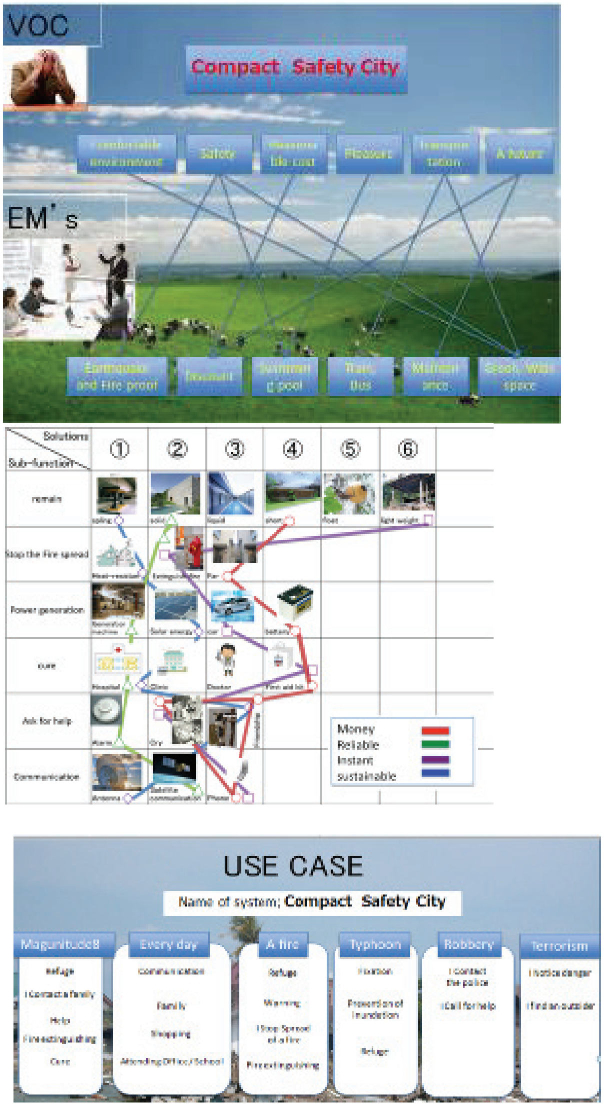


Figure 4-9 VOC and USE CASE

Step 2. Regulatory requirements

Not all requirements are known to the customer (JGC), so we must document requirements that are dictated by management or regulatory standards that the project (BCP plan) must adhere to.

Step 3. Customer importance ratings

On the scale from 1(worse)-5(better), we rate the importance of each requirement.

Step 4. Customer rating of the competition

In this step, we ask our customer (JGC) how our plan rates in relation to the competition. Additional rooms that identify goals for continuous improvement, customer complaints, etc., can be added.

Step 5. Technical descriptors--- the voice of the engineer

According to our customer's requirement, we determine the project specification; however, new measurements can be created to ensure that our project is meeting JGC's needs.

Step 6. Direction of improvement

After we define the technical descriptors, a determination must be made as to the direction of movement for each descriptor.

Step 7. Relationship matrix

This relationship matrix is where we determine the relationship between JGC's needs and our project plan to meet those needs. Relationships can either be weak, moderate, or strong and carry a numeric value of 1, 3 or 9.

The Figure 4-10 shows that, according to the three assumptions we made before, building a compact city in Tama is relative cost-effective.

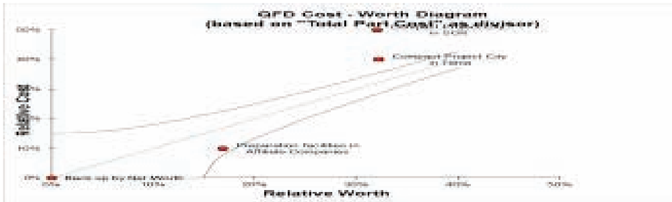


Figure 4-10 QFD Result

FMEA

A failure modes and effects analysis (FMEA) is a procedure in product development and operations management for analysis of potential failure modes within a system for classification by the severity and likelihood of the failures. (From Wikipedia) FMEA can provide an analytical approach, when dealing with potential failure modes and their associated causes. When considering possible failures in a design (in our case, they are safety, cost, performance, quality and reliability), we can get lot of information about how to alter the development process, in order to avoid these failures. FMEA provides an easy tool to determine which risk has the greatest concern, and therefore an action is needed to prevent a problem before it arises. The development of these specifications will ensure the products or the service will meet the defined requirements. The main function we use it in our ALPS project is to list and prioritize our failure modes.

Our FMEA table is developed in three main phases: severity, occurrence and detection. However, before starting with an FMEA, we complete some pre-work to confirm that robustness and past history are included in the analysis.

The robustness analysis contains the interface matrices and boundary diagrams. A lot of failures are due to noise factors and shared interfaces with other parts and systems, because we tend to focus on what we can control directly.

The interface matrices consist of input, interface and output three parts. We define the input as investment (funds), employees (labors) and facilities (offices and equipments). The output of our program is human safety (no one get hurt or died), business continuity (without losing customers) and cost effectiveness (low cost). The key point in our project is how to design the interface, which means using the existing materials (money, labors and facilities) to keep the working employees and business safe after a serious earthquake.

The boundary diagrams show the starts which we can take measurements to control and which we cannot. For those factors we can take action to influence (fire alarm system, fire attention education, etc.), details plan should be make to avoid or limit the risks. And for those factors we cannot (thunder, spy, power cut, etc.), we have to consider the possibility of their ability of provoking the disasters and to what extent they can influence the disaster. Then details plan should be designed to reduce the negative effect from the disaster or transfer it into the risk which we have already haven robust plan to deal with once it happens.

To start it is necessary to describe the system and its function. We list twelve functions and for each function, there is at least one potential failure mode which is generated according to the functional requirements and their effects. Examples of failure modes in our FMEA are: out of order of fire fighting system, high temperature or smoking. A failure mode in one component can lead to a failure mode in another component; therefore, each failure mode should be listed in technical terms and for functions. A failure effect is defined as the result of a failure mode on the function of the system. In this way, it is convenient to write thesis effects down in terms of what we might see or experience. Examples of failure effects in our FMEA are: catching fire or building damage. Each effect is given a severity number from 1 (no danger) to 10 (critical). These numbers help us to prioritize the failure modes and their effects. If the severity of an effect has a number 9 or 10, actions are considered to change the design by eliminating the failure modes. A severity rating of 9 or 10 is generally reserved for those effects which would cause injury to a user or otherwise result in litigation.

The occurrence can be defined by looking at the cause of a failure mode and how many times it occurs. A failure cause is looked as a design weakness. Examples of causes in our FMEA are: no water, lack of education or poor quality of building materials. A failure mode is given an occurrence ranking from 1 to 10. Actions need to be determined if the occurrence is high (>4 for non-safety failure modes and >1 when the severity number is 9 or 10).

When appropriate actions are determined, we test their efficiency and design verification is needed. Now the proper inspection methods need to be chosen. We look at the current controls of the system, that prevent failure modes from occurring or which detect the failure before it reaches our customers. And then we identify testing, analysis, monitoring and other techniques that can be or have been used on similar systems to detect failures. From these controls we can learn how likely it is for a failure to be identified or detected. Detection number ranks the ability of planned tests and inspections to remove defects or detect failure modes in time. A high detection number indicates that the chances are high that the failure will escape detection.

After these three basic steps, risk priority numbers (RPN) are calculated. Actually, RPN do not play an important part in the choice of action we made against failure modes. They are more threshold values in the evaluation of these actions. After ranking the severity, occurrence and detestability the RPN can easily calculated by multiplying these three numbers: RPN=S*O*D. After this we can easy determine the areas of greatest concern. The failure modes that have the highest RPN should be given the highest priority for corrective action. After these values are allocated, recommended actions with targets, responsibility and dates of implementation are noted. These actions should include specific inspection, testing and quality procedures, redesign, adding more redundancy and limiting environment stresses or operating.

The Figure 4-11 below shows our final FMEA table with priority, risk analysis table and recovery plan. The whole FMEA table will be attached in the Appendix part.

No.	Function or Requirement	Potential Failure Modes	Potential Causes of Failure	Occurrence	Local Effects	End Effects on Product, User, Other Systems	Severity	Detection Method/ Current Controls	Detection	RPN	Actions Recommended to Reduce RPN
1	To prevent from Fire	Kid's play with Fire	No attention. Lack of Education	6	Catch Fire	Body hurt and wealth lossing	8	Kids education and fire detectors	4	192	Warning sign and sensitive fire detectors
		Smoking Fire	No attention	7	Catch Fire	Body hurt and wealth lossing	8	Smokng area and fire detectors	2	112	Warning sign and fire extinguisher in smoking area
2	To prevent from Polluted Water/Air/Soil	Close to Industry	No feasibility study. Working Convenience	4	polluted environment	Getting disease	6	landscape garden	7	168	Purification system or far from factories
3	To prevent from Earthquake	Weakness of Building structure.	Poor quality of Building Material	3	Building damagement	Body hurt and wealth lossing	9	Follow natianal standars	4	108	Special building structure for specail projects
4	To provide with Medical Care(First Aid)	Death Rate Increasing	Delay of First Aid and insufficient of care	4	Insufficient of care	Death or badly hurt	8	First aid centre	4	128	Hospital that can provide enough medical service after serious disaster
8	To provide with secured communication	line Cut.	Criminal /Nature disaster.	6	Communication interruption	Reluctant to stay safe city	7	Professional mangement	4	168	Back up data with off-site storage system
11	To provide with temporary transportation facilities.(Motor Bike, Car)	No fuel	Too expensive	3	No transportation	Feel uncomfortable	7	Fuel supply from nearby towns	8	168	Gas/fuel station construction
12	To operation and Maintenance of facilities.(Safety guard System , keep clean inside)	Power Shut down	Nature disaster	7	Criminal breakthrough	No secure	9	Reserve source of electrical/gas/water power	4	252	New engergy generator(solar, wind,geothermal energy)
		Expensive	High technical cost	6	Criminal breakthrough	No secure	7	Related service company	4	168	Update the facilities according to the demands

Figure 4-11-1 Failure mode with high RPN

No.	Environment cause	Risk event	Risk effect	Likelihood	Impact	Mitigatiion action	Risk owner	Mornitoring	Department
1	Nature or Artificial	**Catching Fire**	1.Power shut down; 2.Injured or death; 3.Finacial and data Loss; 4.Project delay; 5.Pollution;	High	High	1.Reserve power supply; 2.First aid system; 3.Insurance policies; Data and document back up; 4.Rescheduel and compensate; 5.Fire control as soon as possible;	Project Manager	Daily check the fire-fighting system's validity	Fire Department Safety Officer
2	Nature or Artificial	**Losing contact**	1.Project delay	High	Medium	Explore methods to get contact: cellphone, internet, Email…	Project Manager	Keep these contact methods valid	All staffs and managers
3	Nature or Artificial	**Data loss**	1.Losing customers 2.Project delay	High	Extreme	Back up the data in a off-site PC or Disc	Project Manager	Upgrade the data daily	Network security department
4	Nature or Artificial	**Losing customers**	Project cancelled	High	Extreme	1.Keep important contact infromation on employees' personal mobile phones; 2.let media tell customers what happens to our business; 3.Help clients plan for the unplanned	Project Manager	Keep touch with clients and tell them about the process of projects	Service department
5	Aritificial	**Invest in protection in wrong areas**	Project delay	High	Medium	Prioritize the steps to repair business after a disruption	Project Manager	Have a recovery plan and keep on modifying it accoring to the real situation.	Managers
6	Aritificial	**How no intricate details of how business functions**	Project delay	High	Medium	Understand exactly where their profits coming from, the key things need to be done and in what timeframe if that was disrupted.	Project Manager	Identifying the critical projects and services figure out the employees who have the biggest role in delivering those products and services to customers.	All staffs and managers
7		**Disorder management**	Project failed or delay	High	Extreme	1.Appoint someone to coordinate the efforts to create a business continuity plan 2.Dynamic group to get people togeter talking about exactly what they do and how to do it. 3.Determine the roles in the organization and what tools they need to fullfill them. 4.Make sure each department or team of employees has developed their own plan to recover operations independently. 5.Constant communication among high-level management.	Project Manager	Put them in writing and make it clear, concise and simple enough for any employee to understand	Managers

Figure 4-11-2 Risk analysis table

Activities	24hours	48hours	72hours	1week	1month
1	First aids	Transportation	Energy supply	Facilities recovery	
2	Electricity	Connection with customers	Connection with medias		Recovery to the original business condition
3	Water	Data recovery	Home working		
4	Telecommunication				

Figure 4-11-3 Recovery plan

5. DESIGN RECOMMENDATION

(Fuma-san Parts)

1. A showcase of your proposed innovation, final prototype.

This prototype shows employee situation's(fig.1). And, fig.1a and fig.1b is closed up for a part of system. Fig.1a is Yokohama vision at disaster happen, broken load, and employee upset who has some children in the house, house burning. So, If JGC have stable building, employees cannot go to head-office.

Figure 1: whole prototype vision


Figure 1(a): Yokohama-side prototype vision


Figure 1(b): suburbs-side prototype vision

Following to AS IS TO BE, fig.1a introduce AS IS. Then, fig.1a-b introduce TO BE.

■subject

Suggestion of BCP with the cost-effectiveness in the JGC main office

■substance

Visualization and the comparison between Yokohama city (figure1a) and company house for anti-disaster measures(figure1b) after the earthquake occurrence. It visualize for “AS IS”,”TO BE”.

■detail

＜Head office in Yokohama＞

The main office of Yokohama is safe.

The employee tries the attendance.

A road collapses and cannot go to the main office.

The employee cannot go for work that leaves a child in the house.

All the public transport stops.

＜company house for anti-disaster＞

Build the company house in the suburbs Because it do not receive an earthquake at the same time.
Work is possible at the disaster in a company house
A team member lives in the company house
A family live together, and a job works in peace

2. Diagrams of your systems, use-case, scenarios, etc.

■diagram

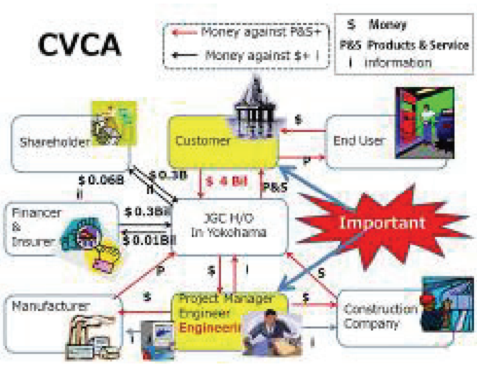


Figure 2: CVCA

Understand it from figure 2, It is had dealings a particularly big amount of money in the relations of the visitor and it is Project-Manager and Engineer to support it.

Because when either PM or Engineer lacks by disasters, it becomes difficult to go ahead with a job. According to the above, it is the most important to ensure the security of PM and Engineers as BCP in JGC. As the way, we suggest the foundation of the company house for anti-disaster measures.

Figure 3 of the next page is show about a company house for anti-disaster measures.

Figure 3: system diagram about company house with anti-disaster

■system diagram about company house with anti-disaster

＜what is company house for anti-disaster ＞

It is a system it lives in the company house for anti-disaster measures with a family until a project period in Japan ends 177 people that it is thought that it is necessary to a minimum when I go ahead with PM, a project including Engineer, and to continue working in a company house at the time of the disaster for anti-disaster measures.

＜Use Case＞

Figure 3 is a diagram of system when I used a company house for anti-disaster measures.

Blue lines show actions normally and A red line shows a disaster occurrence action.

＜Scenario＞

・Usual time

The PM and Engineers live in the company house for anti-disaster measures with a family and go to work to the main office for one hour.

・disaster

The PM and Engineer continue working in an office part in the company house for anti-disaster measures without going to the Yokohama main office.

3. Product Specification or Process Specification (design layout, part geometry, materials, process steps, times, resources, service process.)

4. Implementation Plan(Service delivery, partnerships, part fabrication, assembly, training).

■How to achieve
・boss's agreement
・stake holder's agreement
・selection of land
・approval of employee and employee's familiy

5. Life-Cycle Plan (testing, service, recycling, etc).

■Life Cycle Plan

The purchase of the land
↓
Construction
↓
I replace a member every two years and manage it
↓
Sell it ten years later
↓
New construction

6. Detailed descriptions of the functions, structure and operation of your system.

■detail of function

To be available life with family.

To reach workspace without impact of transportation.

To be available enough level of engineer

To be available enough number for engineer

To be available enough space for work

To be available enough facilities for work

To be available work environment without worrying about the family after disaster.

It can accommodate 177 people

■land

The range that the commuting from the main office by train or car about one hour (figure5)

Figure 5: commuting to main office.

6. COMPETITIVE ANALYSIS

Konno-san Parts

● Performance of BCP plan

When we consider the cost–effectiveness, we should define both of the performance and cost of the plan.

For this project we define the performance of this BCP is the shortened recovery period and also minimized penalty due to such shortened recovery period.

And we define the cost of BCP is to build and operate company residence with emergency temporary office space.

After interview of JGC, we could know that JGC think normal recovery period 120 days after earthquake.

We assume that if there is this BCP JGC can achieve recovery period maximum 30days after earthquake.

So we assumed the 90days and ¥9.36Billion are evaluated as performance of this BCP.

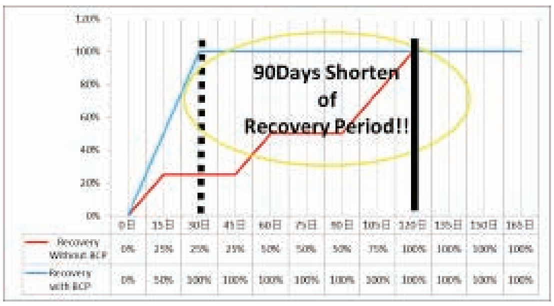


Figure 6-1: Comparison of recovery period.

Based on the above definition, we can calculate IRR as follows;

＜date＞

Project period 10Years

Initial investment: 4,420million yen

Repair cost after Earthquake 200million yen

Rate of Liquidated damage(LD) 104million yen/day

Period of LD 90days

member 1 team 7men×5 team×5family ＝175men

Facility cost 10million yen/ PM,Engineer

Rental fee for land 0.01million yen/m2/year

O&M Cost 0.0024million yen/m2/year

IRR Calculation Assumption Sheet

Ref	Item	Basis and Unit		Amount
1	Project Period	Years		10
2	Disaster Occurence	-rd years		5
3	Initial Investment	Million Yen		4,420
4	Repair Cost	Million Yen		200
5	Rate of Liquidated Damage(LD)	Million Yen/day		104
6	Period of LD	日間		90
7	Number of Team live in Compact City			5
8	Number of PM and PE of team			7
9	Number of resident in Compact City			175
10	Facility Cost	Million Yen/PM&PE		10
11	Rental Fee for land	Million Yen/m2/Year		0.01
12	Daily O&M Cost	Million Yen/m2/Year		0.0024
13	IRR	%		18.2%

(Unit: Million Yen)

Ref	Item	Amount	Basis of Calculation		0	1y	2y	3y	4y	5y	6y	7y	8y	9y	10y
14	Land Cost				0										0
15	Building Cost of C.City	4,070			-4,070										3,204
16	Facility Cost	350	See Item 10		-350					-550					
17	Investment Cost	4,420	=15+16		-4,420	0	0	0	0	-550	0	0	0	0	3,204
18	Daily O&M Cost	18,500	See Item 12			-44	-44	-44	-44	-44	-44	-44	-44	-44	-44
19	Rental Fee for Land	6,000	See Item 11			-60	-60	-60	-60	-60	-60	-60	-60	-60	-60
20	Others														
21	Operational Expence		=18+19+20		0	-104	-104	-104	-104	-104	-104	-104	-104	-104	-104
					0										
22	LD	104	See Item 5	9,360						9,360					
23	Depreciation	Amount	Priod(years)												
24	Depreciation Land	N/A													
25	Depreciation Building	4,070	47			87	87	87	87	87	87	87	87	87	87
26	Depreciation Facilities	350	4			88	88	88	88	88	88	88	88	88	88
27	Tax benefit		=(25+26)*(1-41%)			103	103	103	103	103	103	103	103	103	103
28	Cash Flow	/ Year	=17+21+22+27		-4,420	-2	-2	-2	-2	8,808	-2	-2	-2	-2	3,202
29	Cash Flow	Accumulated			-4,420	-4,422	-4,423	-4,425	-4,427	4,382	4,380	4,378	4,377	4,375	7,577

Figure 6-2: IRR calculation

We also did sensitivity analysis changing following factor;

1. Earthquake occurrence: from 1st year to 10th year.
2. Covered number of project team : 7 or 18

● Analysis

1. If earthquake happen faster, IRR is higher.
2. If covered number of project is smaller, IRR is higher.
3. Even the covered number is 18 staffs, minimum IRR is 3.8% which higher than yield of 10 years' Japanese treasury bond.
4. Since JGC's ROA of FY2009 is 6.3%, if large-scale earthquake occurs within 3years, both scenario higher than ROA.

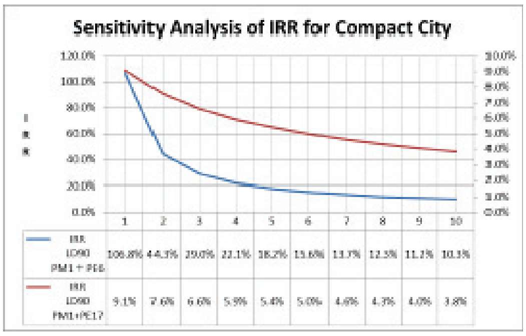
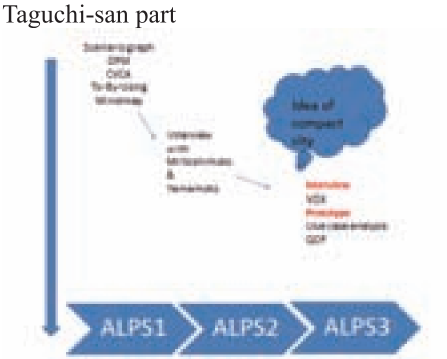
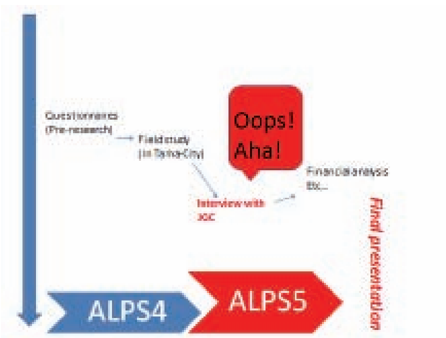


Figure6-3: Sensitivity Analysis

7. ALPS ROADMAP AND REFLECTIONS

Taguchi-san part





8. CONCLUSION AND FUTURE WORK

Conclusion

We reached following conclusions.

A) For cost-effective approach, the performance of the plan and boundary of cost should be defined.

B) For the evaluation of cost-effectiveness of BCP for earthquake, shortened the recovery period and the consequent mitigated cost can be defined as performance of it.

C) Based on the above definition, IRR method can be used for quantitative analysis in order for company to decide the investment.

D) Based on IRR analysis this BCP is cost–effective.

Future work

In order to increase the reality, all conditions of IRR calculation should be reviewed by JGC.

9. ACKNOWLEDGMENTS

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Thank you very much for all group member & Family.

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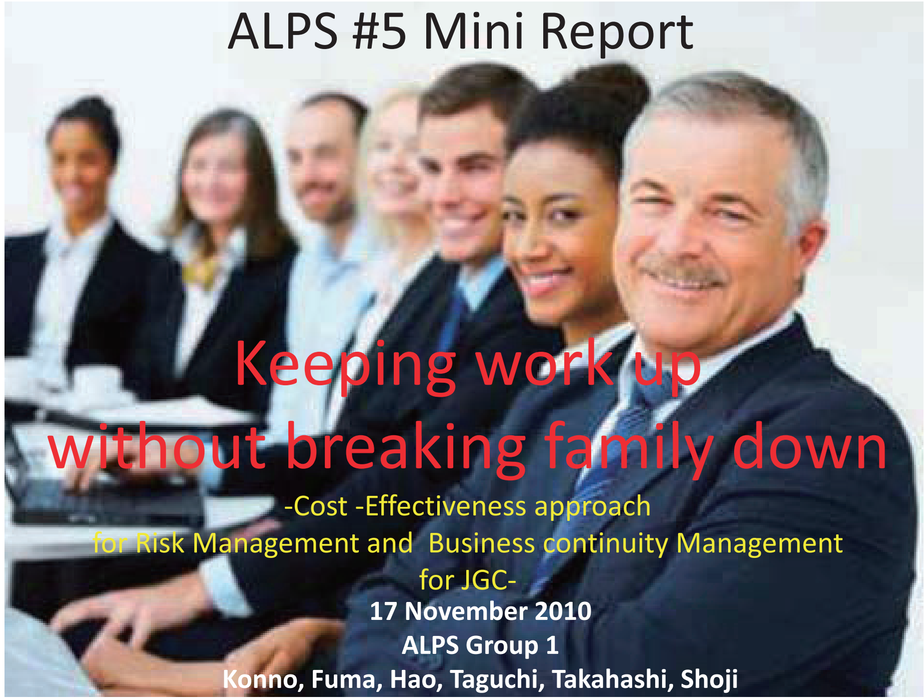
Group 1’s Final Presentation Slides



Video Commercial

☐**Who is your audience?**

- **JGC and SDM**

2

Video Commercial

Movie scenario is following sentence

1. We assume the big earthquake to happen in Japan near future.
2. Currently JGC has a BCP for earthquake based on the assumption which the head office building keeps standing without any damage from Kobe-Class Earthquake.
3. However, it is not sure that JGC can really continue his work after earthquake.
4. We assume that Kobe-Class Earthquake hits in Yokohama Area at 201X year.
5. The earthquake destroys some buildings, houses fall down, road cracked, train derailed. Also some house burned.
6. If current BCP, the PM has to go to JGC's Head office in Yokohama, because PM has to lead his project whether his family agree or not.
7. He should go to the head office by walk because all public transportations are out of service.
8. He finally arrives at head office in Yokohama then open the door.
9. He think many members are there already. But, actually nobody is there.
10. They cannot work and project delays 140days.
11. Then Client send JGC an Invoice of relevant Liquidated Damage with huge amount.
12. On the other hand, if JGC build a company residence with temporary emergency office.
13. All resident project managers and project engineers can do their work as usual even after earthquake.
14. Projects are successfully completed as planned performance, budget and schedule.
15. Everybody feel safety and security and Happy !!

3

Elevator Pitch Competition

Oh, Sorry! I am very sorry for my part. I just visited one of my friends in hospital. And of course, you know, the hospital is always the place you will easily get infected by others. 10”

You know that the earthquake in last week was really a disaster; and very bad luck; he was badly hurt. He is a project manager in a big company, at that time he was busy with his project. But now everything stops because the mess made from the earthquake. And his company was suffered with big loss. Their customers got very angry with the current situation. The company almost lost them all. 30”

As a consultant and closed friend I told him thousands of times that they should have a BCP plan to protect their business and themselves against disasters. But everything I said to him he treated as a joke. And now, pay back time.

Moreover, can you imagine that 70% of the companies don't have their own BCP plans in Japan, but almost 20% of earthquake over the world happens here, which means at least 1600 companies need to have one? As far as I know, Toyota has one, JGC has one… which our company made for them, I mean.

As you can find, the market is really big. And it is kind of “double-win business” with perfect return, more or less 70%, I think. Most of our team members used to work in top companies, which means they are very professional in designing a suitable BCP plan according to the companies’ real situation and requirement.

Now we are anticipating 100 million yen this round to be used for employee building, increased office space, and marketing.

We have a compelling two page executive summary that I would like to send you. Can I get your address? 30”

4

Scorecarding, Design of Experiment

□Scorecarding, Design of Experiment

- Our Customer's(JGC's) Biggest Y :
  ⇒Customer Satisfaction e.g Oil Company, OPEC Countries etc
  =To complete Projects within
  planed Performance, Budget and Schedule
- Control Factors (X's)
  ⇒①Availability of Human Resource
  " Project Manager & Project Engineer"(man)
  ②Availability of Financial Resource (¥ or $)
  ③Availability of Employee's Time Resource(day or hour)
  ④Availability of Facilities
  (PC, Communication Tools, office facilities)
  ⑤Availability of Infrastructure
  (Public transportation, Electricity, IT Network, Water)

5

Scorecarding, Design of Experiment

□Scorecarding, Design of Experiment

- What can JGC control? design "knobs")
  ⇒All of the above
  except
  Employee's Time Resource and Infrastructure
- What are JGC's levels?
  ⇒① Not Plan yet
  ② Not Plan Yet
  ③ Not Considered yet
  ④ OK. Head Office is robustly architected
  ⑤ Only IT Network system is reinforced

6

Scorecarding, Design of Experiment

- Noise Factors (V's)
  ⇒
  ① Lack of the number of
  Project Manager & Project Engineers
  ② Management Decision
  ③ Time constrain
  due to private/Family affair
  ④ Damaged facilities
  ⑤ Damaged Infrastructure

7

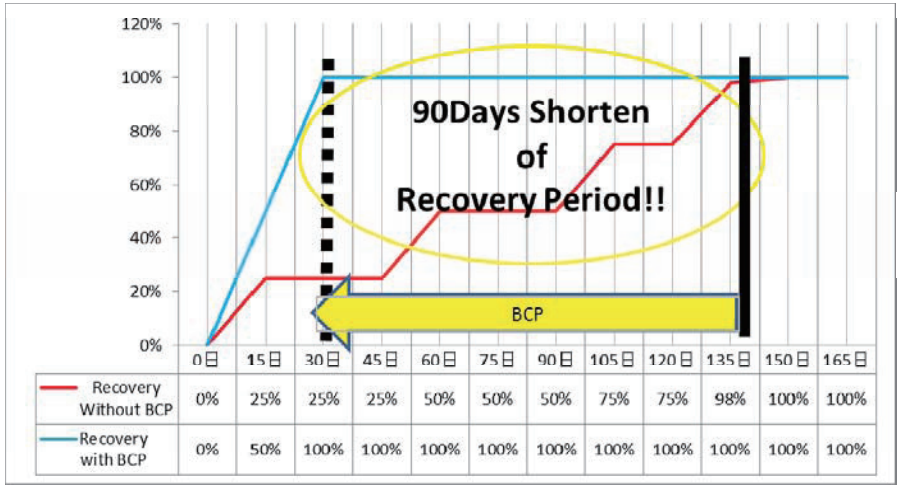
Scorecarding, Design of Experiment

□Scorecarding, Design of Experiment

- Transfer Function
  Economical Scenario Analysis
  by using IRR.
- How can you conduct experiments with your prototypes?
  Economical Simulation
  ⇒IRR sensitivity analysis.
  Physical Experiments
  ⇒Visualizing the Situation.

8

Financial Evaluation
Assumption of BCP's Performance



9

Financial Evaluation
IRR Calculation Sheet for Compact City

IRR Calculation Sheet

Ref	Item	Basis and Unit		Amount
1	Project Period	Years		10
2	Disaster Occurence	-rd years		5
3	Initial Investment	Million Yen		4,420
4	Repair Cost	Million Yen		200
5	Rate of Liquidated Damage(LD)	Million Yen/day		104
6	Period of LD	日間		90
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8	Number of PM and PE of team			7
9	Number of resident in Compact City			175
10	Facility Cost	Million Yen/PM&PE		10
11	Rental Fee for land	Million Yen/m2/Year		0.01
12	Daily O&M Cost	Million Yen/m2/Year		0.0024
13	IRR	%		18.2%

(Unit : Million Yen)

Ref	Item	Amount	Basis of Calculation		0	1	2	3	4	5	6	7	8	9	10
14	Land Cost				0										0
15	Building Cost of C.City	4,070			−4,070										3,204
16	Facility Cost	350	See Item 10		−350					−550					
17	Investment Cost	4,420	=15+16		−4,420	0	0	0	0	−550	0	0	0	0	3,204
18	Daily O&M Cost	18,500	See Item 12			−44	−44	−44	−44	−44	−44	−44	−44	−44	−44
19	Rental Fee for Land	6,000	See Item 11			−60	−60	−60	−60	−60	−60	−60	−60	−60	−60
20	Others														
21	Operational Expence		=18+19+20		0	−104	−104	−104	−104	−104	−104	−104	−104	−104	−104
					0										
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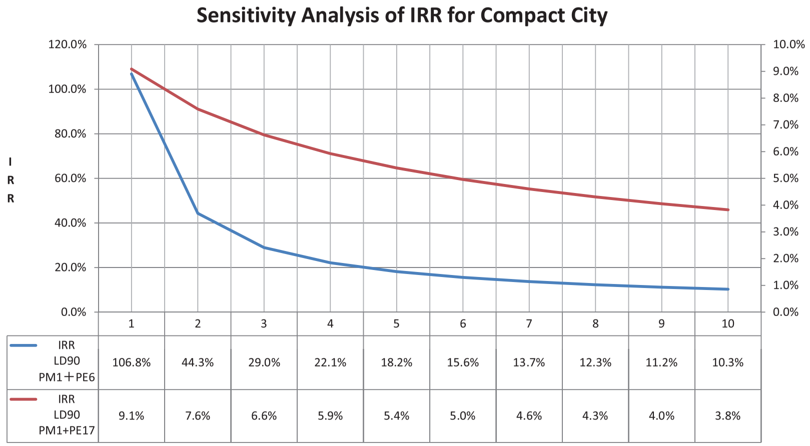
29	Cash Flow	Accumulated			−4,420	−4,422	−4,423	−4,425	−4,427	4,382	4,380	4,378	4,377	4,375	7,577

10

Financial Evaluation
Sensitivity of IRR for Compact City



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