Balanced scorecard for natural disaster management projects

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Abstract
Purpose – With the recognition of the necessity for effectively and successfully managing natural disaster projects for saving human lives and preventing and minimizing the impacts of disasters on socio-economic developmental progress, this paper seeks to propose a balanced scorecard (BSC) approach in order to maximize the possibilities of desired outcomes from projects.

Design/methodology/approach – The BSC approach, which has been widely accepted and used in business organizations, can be adapted for natural disaster management projects. An application of this BSC approach to disaster management projects is discussed with a real flood disaster management project.

Findings – In the BSC approach, performance measures should be established in four areas: donors’ perspective; the target beneficiaries’ perspective; the internal process perspective; and the learning and innovation perspectives. Measures for four areas in each of the five generic phases of managing natural disasters (i.e. preparedness, early warning, emergency relief, rehabilitation and recovery) allow project managers to identify problem areas and areas for further improvements. Ensuring success in one phase will lead to success in the subsequent phase because success in one phase will be the input for the following phase.

Research limitations/implications – In general, this study demonstrates an application of the balanced scorecard approach to natural disaster management projects and, in particular, to a real flood disaster management in Hat Yai Municipality, Southern Thailand. Future research might focus on other types of natural disaster.

Practical implications – Using the balanced scorecard, project managers can understand problem areas as well as areas for improvement in current projects, which would enhance their abilities to take corrective actions that ensure and maximize the possibilities of successful outcomes from implemented projects.

Originality/value – This paper proposes the BSC approach for successfully managing natural disaster projects. This management approach can be applied to various natural disaster management projects.

Keywords Balanced scorecard, Natural disasters, Emergency measures, Rehabilitation, Floods, Thailand

Paper type Conceptual paper

Introduction
Some 75 percent of the world’s population lives in areas that have been affected at least once by earthquakes, tropical cyclones, floods or droughts between the years 1980 and

The first author would like to thank the German Academic Exchange Service (DAAD) for providing a postdoctoral scholarship award for his research stay at the Universität Karlsruhe (TH) in Germany.
2000. Billions of people in more than 100 countries are periodically exposed to at least one of these events. In the last two decades, more than 1.5 million people have been killed by natural disasters. Globalization and the growing interconnectedness of global society mean that catastrophic events in one place have the potential to affect lives and public policies in distant locations (United Nations Development Programme, 2004). With the acknowledgement of the rise in natural disasters and the urgent need for natural disaster risk reduction, all states around the world made a resolution at the World Conference on Disaster Reduction in 2005. The resolution expects to achieve the outcome of a substantial reduction in disaster losses, in lives and in the social, economic and environmental assets of communities and countries in the next ten years (United Nations, 2006). Achieving such an outcome relies on the efforts and capabilities of every government towards the effective management of natural disasters in their own country.

Natural disaster management can be viewed as public project management in which the government is a major stakeholder (Moe and Pathranarakul, 2006). According to Turner (1993), a project has three essential features:

(1) uniqueness – no project before or after will be exactly the same;
(2) transient nature – every project has a definite beginning and end; and
(3) a novel process – no project before or after will use the same process.

These features create three pressures:

(1) subject to uncertainty;
(2) a need for integration; and
(3) undertaken subject to urgency.

Therefore managing such projects poses several challenges for project managers.

Ensuring successful outcomes from implementing natural disaster management projects could result in reducing the risks from natural disasters and minimizing the negative impacts on human, social and economic environments. Effectively measuring performance in each of the phases in a project life cycle is necessary to examine the current status and to find out problem areas that require further improvement. The success of one phase will be the input for the following phase. Therefore, measuring performance against standard baselines in each phase of the project life cycle is important in order to ensure desired outcomes for success.

Among the different performance measurement approaches, the balanced scorecard (BSC), first introduced by Kaplan and Norton (1992), can be used to check the current status of performance in business organizations. This BSC approach was later applied to business project management (Stewart, 2001). Through the application of BSC, which provides a more comprehensive measurement system, project managers in natural disaster management can easily identify problem areas that require improvement, leading towards the effective and successful implementation of natural disaster project management.

This study aims to answer the following research questions:

(1) What are natural disasters and their negative impacts?
(2) How can natural disasters be managed?
Defining disasters
A disaster can be defined as a situation which overwhelms local capacity, necessitating a request to the national or international level for external assistance, or is recognized by a multilateral agency or by at least two sources, such as national, regional or international assistance groups and the media. According to the Emergency Disasters Database (2006), disasters are classified as natural disasters or technological disasters. To be recorded as a disaster, an event must satisfy at least one of the following criteria:

- ten or more people reported killed;
- 100 people or more reported affected;
- a declaration of a state of emergency; or
- a call for international assistance.

The United Nations (2006) classified natural disasters into:

- hydro-meteorological disasters, including floods and wave surges, storms, droughts and related disasters such as extreme temperatures and forest/scrub fires;
- geophysical disasters, including earthquakes and tsunamis and volcanic eruptions; and
- biological disasters covering epidemics and insect infestations.

Technological disasters consist of:

- industrial accidents;
- transport accidents; and
- miscellaneous accidents.

Among natural disasters, floods, windstorms, droughts and geophysical disasters have shown the fastest rate of increase over past years.

Natural disasters and impacts
Today, the world is facing natural disasters on an unprecedented scale: on average more than 255 million people were affected by natural disasters globally each year between 1994 and 2003, with a range of 68 million to 618 million. During the same period, these disasters claimed an average of 58,000 lives annually, with a range of 10,000 to 123,000. In 2003, one in 25 people worldwide was affected by natural disaster (Guha-Sapir et al., 2004).

The occurrence of natural disasters during the period of 1974-2003 show an increasing trend (Table I). A higher frequency of occurrence took place in Asia, which is mainly comprised of developing countries. The number of people who were killed and affected by natural disasters was highest in Asia, while Europe recorded the lowest number of victims. In other words, many people were killed and affected in developing countries due to natural disasters (Table II). In terms of economic losses, Asia represents the largest share of total world economic losses (Table III).
Natural disaster management

Phases in natural disaster management

According to the study of Moe and Pathranarakul (2006), disaster management includes five generic phases:

1. prediction;
2. warning;
3. emergency relief;
4. rehabilitation; and
5. reconstruction (Figure 1).

The prediction phase includes mitigation and preparedness activities in which structural measures are undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards and non-structural measures are

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Source: United Nations
taken in advance to ensure effective response to the impact of hazards by establishing timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

The warning phase refers to the provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare an effective response.

The emergency relief phase includes the provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of immediate, short-term, or protracted duration.

Rehabilitation consists of decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.

Reconstruction refers to the rebuilding of damaged living conditions of the stricken community with the aim of long-term sustainability.

In a natural disaster management life-cycle, there are four essential activities conducted in the project life-cycle:

1. mitigation;
2. preparedness;
3. response; and
4. recovery.

Mitigation activities include structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Preparedness deals with the activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.
Response refers to the provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

Recovery involves decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.

Mainly, natural disaster management projects are viewed as public projects because the major stakeholder is the state. In natural disaster management, there are differences between natural disaster risk management (NDRM) and natural disaster management (NDM), public and private projects, and proactive and reactive approaches.

**Natural disaster risk management (NDRM) versus natural disaster management (NDM)**

Natural disaster risk management includes phases of prediction, warning, and emergency relief while natural disaster management consists of all phases in the disaster management project life cycle, namely prediction, warning, emergency relief, rehabilitation, and reconstruction.

**Proactive versus reactive approach**

An integrated approach to natural disaster management projects comprises both proactive and reactive approaches. A proactive approach requires the identification of risk, and based on the risk identified, the activities of mitigation, preparedness and partial response in the phases of prediction and warning. The reactive approach includes assessing impacts and their level. Identification of risk is crucial in the proactive approach, whereas impact assessment is vital in the reactive approach.

**Public versus private projects**

Public projects or development projects are normally aimed at reducing poverty and elevating living conditions (Youker, 1999). Thus, natural disaster management projects can be viewed as public projects. Therefore, in this study, natural disaster management projects are viewed as public projects that require an integrated approach.

**Balanced scorecard (BSC) and natural disaster management projects**

*What is the BSC approach?*

The BSC approach was first initiated in the work of Kaplan and Norton (1992). The BSC allows managers to look at a business in four areas:

1. financial perspective (how do we look to shareholders?);
2. customer perspectives (how do customers see us?);
3. internal perspective (what must we excel at?); and
4. innovation and learning perspective (can we continue to improve and create value?).

Kaplan and Norton (2000) suggest the best way to develop strategy is a top-down approach in which the strategy should begin with a review of the company mission statement and their core values – their destination. Then the strategy must define the
logic of how to arrive at the destination. First, the organization should begin with a financial strategy for increasing shareholder value. Second, it should clearly understand customers’ values and needs. Third, with a clear understanding of financial perspective and customers’ expectations, it should determine the means to achieve financial and customer goals. Fourth, it must define the core competencies and skills of technologies, and the corporate culture needed to support an organization’s strategy.

Can the BSC approach be applied to project management?
The BSC approach was later applied to project management in business organizations in order to perform “health check” throughout the project life cycle. When project managers look at these four business areas, they will begin to understand the true impact of the project’s success in the entire organization and see the dependencies of success (Stewart, 2001). The objectives of BSC in project management are:

- to ensure that measures support the core values and practices of the organization;
- to establish meaningful performance measures (benchmarks);
- to align the measures against the project’s charter (terms of reference); and
- to establish measures that are efficient as well as effective, consisting of the three standard types of measure – outcome, action (performance drivers), and diagnostic (why outcome or action measure is at its current level).

The BSC measurements are chosen by the organization that is instituting them. It uses the measurements the organization establishes to support compliance with the objectives, to reinforce communication of those objectives, to provide continuous improvement toward the objectives through the personal goals of all staff, and to obtain the cooperation of the community (Stewart, 2001).

Can the BSC approach be adapted for natural disaster management projects?
The destination of natural disaster management projects is the core of national policies. National governments must have clear policies for natural disaster reduction and management (Figure 2). These policies must be translated into core values or destinations.

Thus, the Hyogo Framework for Action 2005-2015 strongly urges its member countries that one of the priorities for action is to ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation (United Nations, 2006). Measures for four areas of the BSC have been modified in order to fit with the nature and stakeholders of NDM projects (Figure 3).

Donors’ perspective. Disaster management projects can be financed by a government’s own budgets as well as funds donated by international donors and development agencies. In business organizations, the financial perspective focuses on increasing shareholder value by focusing on two levels of strategies:

1. revenue growth; and
2. productivity (Kaplan and Norton, 2000).

Like business organizations, natural disaster management projects should not focus on revenue growth. However the stakeholders should expect an increase in productivity in
Figure 2.
BSC approach centered at national policies for natural disaster management in a project life cycle phases

Figure 3.
Four areas of measures for the BSC in business organizations and natural disaster management projects
delivering services in preparedness, mitigation, emergency relief, rehabilitation, and reconstruction within budget, in time, and with quality standards.

Target beneficiaries’ perspective. Customers’ concerns tend to fall into four categories:

1. time;
2. quality;
3. performance and service; and
4. costs (Kaplan and Norton, 1992).

In natural disaster management projects, customers are the target beneficiaries who will need timely, quality, high-performance and low-cost services for disaster mitigation, preparedness, response, and recovery activities. It is important at the outset that project managers should clearly understand the actual needs and situations of the target beneficiaries, which will become useful inputs for the initiation of disaster management projects.

Internal business perspective. Kaplan and Norton (1992) argue that customer-based measures must be translated correctly into measures of what the company must do internally to meet its customers’ expectations. Project activities are carried out by the effective use of knowledge, skills, tools and techniques. Therefore, the organization must carefully examine anything that will have an impact on the process of providing products and services in regard to disaster preparedness, mitigation, emergency relief, rehabilitation, and reconstruction. Specific measurements are needed to evaluate the current level of the process in each of the project phases with the aim of increasing its excellence.

Innovation and learning perspective. It is essential for project team members to be innovative and to learn from lessons in order to adopt best practices throughout the project’s life cycle. Kaplan and Norton (2000) point out that organizations invest in three capitals – human capital, information capital, and organization capital – in order to produce the desired products and services. To excel at these services and products, the project must improve the skills of its team members, provide necessary training, and increase their level of knowledge. The project should also invest in system, database, and network infrastructure. In natural disaster management projects, managers must be aware of improving the core competencies of their project team members, creating an effective information network infrastructures and databases, building a culture of learning from previous lessons, and adopting best practices.

How could measures for BSC be established?
Establishing BSC measures must begin with formulating national policies for natural disaster management. Then these policies must be translated into the project’s objectives. Next, a life-cycle framework, which identifies key activities to be performed, major outputs, and key players, must be constructed for the five generic phases of a natural disaster management project. Appropriate balanced scorecard measures to measure performance in each phase can be selected based on project objectives that constitute natural disaster management.
In each phase of a NDM project life-cycle, actual performance is measured against the selected indicators for the BSC approach. When the actual performance is in line with the selected baseline indicators, then best practices are documented. Otherwise, there is a need to fine-tune measures for the BSC and to document the lessons learned (Figure 4).

Figure 5 depicts a life-cycle based framework for each of the five generic phases of natural disaster management project. Instead of measuring overall project success, the scorecard for each phase is measured. The assumption is that different project phases require different ways to succeed. This allows project managers to establish measurements for each phase at the beginning and fine-tune them when changes requested by key stakeholders are made. Ensuring success in one phase will lead to success in the subsequent phase and the overall success of the project.

BSC approach to a real flood disaster management

Hat Yai Municipality flood disaster history
Hat Yai Municipality, which is a center for commercial trade and administration as well as a gateway to Singapore and Malaysia, is located in the Southern part of Thailand. This municipality area is extremely vulnerable to flood disaster due to:
Figure 5.
BSC approach in natural disaster management project life-cycle phases
It has experienced two flood events of catastrophic magnitudes, in 1988 and 2000. The municipality, which is located in the Klong U-Taphao Basin, comprises 33 communities, and covers an area of 20 km² with a population of 160,000 people. One flood disaster event took place between 21 and 24 November 2000, and claimed 30 deaths with an estimated $US220 million in economic damage. It was said to be the worst urban flood disaster in the history of Thailand (Figure 6). Because previous structural mitigation activities such as the construction of levees, drainage canals and water diversion channels did not provide sufficient minimizing impacts and prevent flooding, the municipality was submerged again when the same magnitude of rain fell on 10 December 2003 (Tanavud et al., 2004). This indicated an urgent need for flood disaster management in the municipality.

How can the BSC approach be applied to flood disaster management in the Hat Yai Municipality?

The following illustrates an application of the BSC approach to flood disaster management in the Hat Yai Municipality area. The illustrations include all possible

![Figure 6. Map of water level in 2000 flood event in Hat Yai Municipality](source: Tanavud et al. (2004))
activities that can be carried out in the project life-cycle and the possible outputs that can be produced at the end of each phase.

The BSC approach measures performance against baseline indicators for managing flood disasters, which provide a checklist for project managers. This checklist allows managers to identify problem areas and areas that urgently need further improvement in managing flood disaster in Hat Yai. To establish measurements for the BSC for a flood disaster management project, a life-cycle based framework which identifies key activities, end products and key players in the five generic phases must be constructed (Table IV). Referring to the key activities performed, end products produced, and key players, appropriate performance measurements for BSC that constitute the project objectives are selected.

**Prediction**

Table IV provides key activities, outputs, and key players in the prediction phase. This phase is similar to the initiation and planning phases in project management. The prediction phase requires recognition and identification of the problems associated with flood disasters in Hat Yai. The outputs produced must be linked to the project objectives.

According to PMBOK® Guide Book, the project management process includes inputs placed into processes, tools and techniques used, and outputs produced. Table V shows the inputs and tools and techniques required to produce the desired outputs. The final outputs produced in the prediction phase are:

- flood risk and hazard assessment report;
- project concept paper;
- project documents (scope, budget, organizational set-up, schedule, etc.);
- project agreement with resources and commitments; and
- early estimates of relief needs.

To calculate the risk of natural disaster, there are four parameters:

1. **hazard** – the probability of the occurrence of a potentially damaging phenomenon within a given period of time and space (Tanavud et al., 2004);
2. **risk** – the threat to life or property that may result from the action of a hazard upon some structure, system, or population (French, 1991);
3. **vulnerability** – the degree of loss for a given element or set of elements at risk (Tobin and Montz, 1997); and
4. **elements at risk** – mainly regarded as population, property, and economic activities in a given area (Tobin and Montz, 1997).

Risk is calculated as: \( \text{risk} = (\text{elements at risk}) \times (\text{hazard} \times \text{vulnerability}) \) (Shook, 1997).

Various hazard levels for land use areas – namely residential areas, commercial areas, industrial areas, public utilities and facilities, preservation and recreation areas, agricultural land, water bodies, and miscellaneous – are identified with five level scales (very low, low, moderate, high, and very high). Identification of susceptibility to flood hazard among 33 communities was developed.
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<td>Conducting rapid assessment of needs</td>
<td>Reconstructing damaged houses in the stricken communities</td>
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<td>Estimate social and economic losses</td>
<td>Increase public awareness</td>
<td>Dynamic monitoring of flooded areas</td>
<td>Providing care for injuries, and prevention of and medication for flood-related diseases</td>
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<td>Suggest the best alternative for population withdrawal from areas at risk</td>
<td>Choose appropriate channels for disseminating disaster risks</td>
<td>Estimating the expansion of flooded areas according to meteorological and hydrological forecasting</td>
<td>Providing basic foods and goods</td>
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<td>Suggest the best alternative for storing and transporting flood prevention materials</td>
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<td>Receive approval and commitment from key stakeholders</td>
<td>Provide education on how to use mitigation facilities</td>
<td>Estimating economic damages and recording deaths, injuries, and missing persons</td>
<td>Restoring living conditions to pre-disaster levels</td>
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<td>Funding agency (representative) Consultants Implementing agencies Government (representative) PM team Government (representative) Consultants Implementing agencies' subcontractors, suppliers, partners PM team CBOs, NGOs, international development agencies Subcontractors, suppliers, partners Target beneficiaries NGOs, international development agencies Subcontractors, suppliers, partners Target beneficiaries PM team Funding agency (representative) Government (representative) Implementing agencies Target beneficiaries</td>
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<tr>
<td>BSC areas Donor</td>
<td>Measures</td>
<td>Matching policy priorities and raising the interests of key stakeholders Approval and commitment of sufficient resources to the project by key stakeholders Satisfaction of donors with responsiveness to early warning Good accountability of resource utilization Resources mobilized and used as planned Resources mobilized and used as planned Project completion report accepted by key stakeholders</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Target beneficiaries</td>
<td>Addressing relevant risk and needs of the right target group of beneficiaries Increased awareness of potential disaster risks and vulnerability among communities Emergency and relief services met expectations of target beneficiaries Basic foods, necessities, temporary shelters, and health care services met expectations of target beneficiaries Life restored back to pre-disaster conditions</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Internal process</td>
<td>Right implementing agency which is capable and willing to deliver services Effective communication channels for providing early warnings with accuracy and lead time Timely and responsive relief activities were carried out without delays Providing basic foods, necessities, temporary shelters, and health care services were delivered without delays Project assets transferred, financial settlements completed and team dissolved to the satisfaction of key stakeholders</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Learning and innovation</td>
<td>Sharing previous lessons learned Sharing previous learned lessons and adopting best practices Sharing previous learned lessons and adopting best practices Sharing previous learned lessons and adopting best practices Sharing previous learned lessons and adopting best practices</td>
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</tbody>
</table>

Table IV. BSC for disaster management
Obtaining an early estimate of relief needs is important for emergency relief activities. Overestimations can be due to technical, bureaucratic and political biases. It is obvious that early estimates of impacts and relief needs will always be uncertain (May, 1982). Based on assessment reports, including risk and hazard, mitigation measures are normally generated. The success of mitigation measures relies on the assessment reports produced. First, structural mitigation activities are realized as no longer feasible. Therefore, construction of levees throughout low-lying areas without providing adequate drainage facilities can lead to internal flooding, and drainage canals or diversion channels to prevent and mitigate flood disasters are not feasible. Second, non-structural measures should be adopted. They include the development of land use planning, the installation of flood forecasting and warning systems, the adoption of preparedness measures against flooding, the creation of risk transfer instruments such as insurance in flood risk areas, the creation of a safety culture in flood-prone areas, the creation of awareness and local preparedness to cope with potential disasters. Third, environmental management measures such as enrichment of forest cover to restore its flood protection values, the prevention of encroachment by cultivators, and demarcation of the basin’s headwater source areas.

To measure performance in this phase, the measurements for BSC, which constitute the objectives, can be established in this phase. From the donors’ perspective, they would like make sure that national policies and priorities match the project objectives. In addition, the project can attract the interests of different stakeholders so that they commit resources. From the target beneficiaries’ perspective, it is important from the outset that the project actually addresses their risks and needs. The project should clearly identify the right agency with the capability and willingness to deliver services. This will lead to an effective international business process throughout the project life-cycle. From an innovation and learning perspective, organizational capacity, which includes new measures and improved service deliveries, must be established in the project management office. These objectives can be converted into measures (Table IV). When changes are needed during the project implementation, the measurements can be fine-tuned.

<table>
<thead>
<tr>
<th><strong>Inputs</strong></th>
<th><strong>Tools and techniques</strong></th>
<th><strong>Outputs</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Topographic map (1:50,000 scale)</td>
<td>Geographic Information Systems (GIS)</td>
<td>Maps</td>
</tr>
<tr>
<td>Landsat image (1:50,000 scale)</td>
<td></td>
<td>(1) Flood hazard map</td>
</tr>
<tr>
<td>Boundary map (1:4,000 scale)</td>
<td></td>
<td>(2) Flood risk map</td>
</tr>
<tr>
<td>Elevation map (1:4,000 scale)</td>
<td></td>
<td>(3) Land use changes</td>
</tr>
<tr>
<td>Slope map (1:4,000 scale)</td>
<td>Assessment reports</td>
<td>(1) Flood risk assessment</td>
</tr>
<tr>
<td>Drainage map (1:4,000 scale)</td>
<td></td>
<td>(2) Flood hazard assessment</td>
</tr>
<tr>
<td>Aerial photo (land) (1:4,000 scale)</td>
<td>Hazard analysis</td>
<td></td>
</tr>
<tr>
<td>Aerial photo (road) (1:4,000 scale)</td>
<td>Vulnerable</td>
<td></td>
</tr>
</tbody>
</table>

**Table V.** Project management process in prediction phase applied to Hat Yai Municipality

Source: Adapted from Tanavud et al. (2004)
Natural disasters are inevitable and it is almost impossible to fully prevent the damage that they cause. However, it is possible to reduce the potential risk by developing disaster early warning strategies and to help in rehabilitation and post-disaster reduction (Shaikh et al., 2005). In this warning phase, the main task is concerned with providing timely and effective information in regard to flood disasters. Activities in the early warning phase are conducted based on the risk and vulnerability analysis in the prediction phase. The precision and accuracy of reports in the prediction phase are essential for the success of the warning phase.

Early warning is important in flood disasters because the lead-time for a flash flood is between six and 18 hours, which allows lives to be saved by the evacuation of people and livestock to safe havens (Asia Disaster Preparedness Center, 2005). Therefore, state-of-the-art science and technology such as radar and weather satellite information should be employed in order to improve the accuracy of weather forecasting and warning systems. Activities performed, outputs produced and key players are described in Table VI.

The final outputs should be:
- a report on early warnings;
- educational programs on flood-related diseases;
- educational programs on the use of mitigation facilities;
- mitigation facilities;
- public awareness; and
- lessons learned and adopted best practices.

It is important to note that the assumption of providing the public with information on hazards and how to mitigate their consequences to the public would encourage preparation (Smith, 1993) was unfounded (Paton, 2003). Disaster reduction should follow the developmental process of motivating people to prepare, facilitating the formation of intentions, and promoting the conversion of intentions to preparedness (Paton, 2003).

The donors of the project would like to use the scarce resources available to target beneficiaries effectively. This can result from promoting good accountability of

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Tools and techniques</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experts</td>
<td>Modern weather prediction facilities</td>
<td>Prediction for flood</td>
</tr>
<tr>
<td>Knowledge on weather forecast</td>
<td>Radar</td>
<td>Map of risk-prone areas</td>
</tr>
<tr>
<td>Consultants</td>
<td>Weather satellite</td>
<td>Documents of warning systems</td>
</tr>
<tr>
<td>Information on weather</td>
<td>Communication channels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radios</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Televisions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internet</td>
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</tr>
<tr>
<td></td>
<td>Mobile phones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMS messaging service</td>
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</tr>
</tbody>
</table>

Table VI. Project management process in the early warning phase
resource utilization and responsiveness to early warning. The target beneficiaries should increase their awareness of potential disaster risks and vulnerability. An international business process will be effective when the project chooses the best communication channels for providing early warnings with accuracy and lead-time. The project members should share the lessons learned and adopt best practices (Table IV).

**Emergency relief**

In the emergency relief phase, first and foremost, people and livestock should be evacuated to a safe haven. In addition, the dynamic expansion of flooded areas during the flood should be closely monitored with meteorological and hydrological forecasting. The transport of materials for disaster relief should be optimized (Zhang et al., 2002). The project should systematically record deaths, injuries, and missing persons. Making a concerted effort with community-based organizations (CBOs), non-governmental organizations (NGOs) and international non-governmental organizations (INGOs) is vital for getting emergency relief services to the target beneficiaries.

The final products at the end of the phase should include:

- a report on the disaster’s impacts on human, social, and economic environments;
- deliveries of emergency relief;
- completion of the task of evacuating people and livestock safe havens;
- the delivery of responsive and timely services for emergency relief operations; and
- documents on lessons learned and best practices.

The donors of the project should promote the accountability of resource utilization. In addition, they should mobilize as planned. Any delay in the mobilization of resources will have negative impacts on other activities carried out in the phase or in subsequent phases. Target beneficiaries might expect the timely delivery of emergency and relief services. Sharing previous experiences and adopting best practices should increase the learning and innovation process of the project. These measures constitute the baseline performance of the emergency and relief phase (Table IV).

**Rehabilitation**

In the rehabilitation phase, activities are usually aimed at improving living conditions in the short-term. The project should conduct a rapid assessment of the needs of flood-hit victims in the area. All affected people should be provided with care and medication for flood-related diseases, temporary shelter, and basic foods and goods (Bayleyegn et al., 2006). Most importantly, their living conditions should be restored back to pre-disaster levels.

The final outputs expected should be:

- a report on needs assessment;
- the effective delivery of health care, basic foods and necessities, temporary shelter, and satisfaction with the provision of health care;
- satisfaction with the distribution of basic foods and necessities;
• effective restoration of living conditions; and
• documents on lessons learned and best practices.

Similarly to the other phases, donors will promote good accountability and effective resource utilization. The delivery of basic foods, necessities, temporary shelter, and health care services must meet the expectations of the target beneficiaries. With an effective internal process, they should reach victims in a timely manner. Project members should share lessons learned with others and adopt best practices (Table IV).

Reconstruction
In the reconstruction phase, typical activities carried out are usually aimed at:
• reconstructing damaged houses in stricken communities;
• reconstructing public utilities;
• reconstructing critical facilities; and
• re-establishing commercial and industrial facilities (Zhang et al., 2002).

Upon completion of the phase, a project completion report should be prepared and all pending financial dues should be settled. Project assets should be transferred to other ongoing projects. The project team should be dissolved or transferred to other ongoing projects.

From the perspective of donors, the project completion report must be accepted by all stakeholders with the promotion of good accountability and effective utilization of resources. The target beneficiaries expect that their lives will be restored to pre-disaster conditions. The project transfers project assets, settles financial dues and dissolves the team with an effective internal process. As in the other phases, project members share their experiences and document the best practices (Table IV).

Preparation of management report on balanced scorecard
A management report with appropriate BSC measures will provide a fast and comprehensive view of a natural disaster management project. Managers can get complex information at a glance. An of a management report in the context of the Hat Yai Municipality flood disaster project is given in Table VII.

When scoring against measurements, a traffic light color scheme can be used:
• “green” means that project performance agrees with project plans and stakeholder expectations;
• “yellow” means that deficiencies in project performance have been noted, are being monitored, and corrective action will be implemented in the near future; and
• “red” means that serious deficiencies have been noted, and the project is in jeopardy/crisis (Stewart, 2001).

Conclusion
This study pinpoints that natural disasters have negative impacts on human, social, and economic environments. These impacts cannot be totally prevented, but it is possible to minimize them and to reduce risks through an integrated approach to natural disaster management (Moe and Pathranarakul, 2006). A balanced scorecard
<table>
<thead>
<tr>
<th>Phases</th>
<th>BSC areas</th>
<th>BSC measures</th>
<th>G</th>
<th>Y</th>
<th>R</th>
<th>Average</th>
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<tr>
<td>Prediction</td>
<td>D</td>
<td>Matching policy priorities and raising the interests of key stakeholders</td>
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<td></td>
<td></td>
<td>Approval and commitment of sufficient resources to the project by key stakeholders</td>
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<tr>
<td></td>
<td>T</td>
<td>Addressing relevant risks and needs of the right target group of beneficiaries</td>
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<td></td>
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<tr>
<td></td>
<td>IP</td>
<td>Correct implementing agency, which is able and willing to deliver services</td>
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<tr>
<td></td>
<td>IL</td>
<td>Sharing previous lessons learned</td>
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<td>Y</td>
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<tr>
<td></td>
<td></td>
<td>Total compliance (percent)</td>
<td></td>
<td></td>
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<td>80</td>
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<tr>
<td>Warning</td>
<td>D</td>
<td>Good accountability of resource utilization</td>
<td></td>
<td>Y</td>
<td></td>
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<td></td>
<td></td>
<td>Satisfaction of donors with responsiveness to early warning</td>
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<td></td>
<td>T</td>
<td>Increased awareness of potential disaster risks and vulnerability among communities</td>
<td>G</td>
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<tr>
<td></td>
<td>IP</td>
<td>Effective communication channels for providing early warnings with accurate forecasting and lead time</td>
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<td></td>
<td>IL</td>
<td>Sharing previous lessons learned and adopting best practices</td>
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<td>G</td>
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<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total compliance (percent)</td>
<td></td>
<td></td>
<td></td>
<td>83</td>
</tr>
<tr>
<td>Emergency relief</td>
<td>D</td>
<td>Good accountability of resource utilization</td>
<td></td>
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<td>Y</td>
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<tr>
<td></td>
<td></td>
<td>Resources mobilized and used as planned</td>
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<td>G</td>
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<tr>
<td></td>
<td>T</td>
<td>Emergency and relief services met expectations of target beneficiaries</td>
<td>G</td>
<td></td>
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<tr>
<td></td>
<td>IP</td>
<td>Timely and responsive relief activities were carried out without delays</td>
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<td></td>
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<td>Total compliance</td>
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<tr>
<td>Rehabilitation</td>
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<td>Good accountability of resources utilization</td>
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<td>Resources mobilized and used as planned</td>
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<td></td>
<td>T</td>
<td>Basic foods, necessities, temporary shelters, and health cares services met expectations of target beneficiaries</td>
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<tr>
<td></td>
<td>IP</td>
<td>Providing basic foods, necessities, temporary shelters, and health cares were delivered without delays</td>
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<tr>
<td></td>
<td>IL</td>
<td>Sharing previous learned lessons and adopting best practices</td>
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<td>Total compliance</td>
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<tr>
<td>Reconstruction</td>
<td>D</td>
<td>Good accountability of resource utilization</td>
<td></td>
<td></td>
<td>Y</td>
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<tr>
<td></td>
<td></td>
<td>Project completion report accepted by the stakeholders</td>
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<td>G</td>
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<tr>
<td></td>
<td>T</td>
<td>Life restored back to pre-disaster conditions</td>
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<td></td>
<td>Y</td>
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</tbody>
</table>

**Table VII.** Example of BSC in flood disaster management project

(continued)
approach, which measures four perspectives (donors’ perspectives, target beneficiaries’ perspectives, internal business process perspectives, and learning and innovation perspectives) can provide a continuous assessment of performance in each life-cycle phase in natural disaster management projects. With the dynamic management approach of the balanced scorecard, natural disaster management centering on core values of national policies can be managed effectively and successfully.

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Further reading


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