



SUPPLY CHAIN MANAGEMENT

*Disaster Preparedness Data Warehouse Plan
for
National Disaster Recovery and Rescue Commission (NDRRMC)*

A proposal

Submitted in partial fulfilment

Of the requirement for the degree of

Masters in Information Systems

In

Supply Chain Management

At

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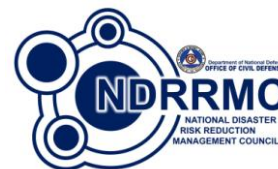


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I. Introduction

This project proposal is to help improve the process of National Disaster Risk Reduction Management Commission (NDRRMC) on Disaster Preparedness and be able to integrate the concepts, learning and discussions gained from the supply chain management class as well as the best practices acquired by each member of the group based on the experiences from workplace.

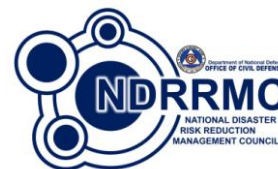
Supply Chain Management (SCM) *is the coordination of production, inventory, location and transportation in order to achieve the best mix of responsiveness and efficiency for the market being served.*¹

SCM will be a guide in improving the process of NDRRMC – Disaster Preparedness. In order to achieve an effective and efficient Supply Chain is guided by seven (7) principles²:

- *Adapt supply chain based on customer needs*
- *Customize the logistics network to the service requirements of customer segments*
- *Align demand planning across the supply chain and ensure consistent forecast and optimal resource allocation*
- *Differentiate product closer to customer*
- *Outsource strategically*
- *Develop information technology that support multi-level decision making and give clear view of the flow of products, services and information*
- *Adopt both service and financial metrics*

¹ Michael Hugos, Essentials of Supply Chain Management (2011), Ch1, p4

² Anderson, D.L, The seven principles of supply chain management. Supply Chain Management Review (1997)



II. Project Overview

A. Current State of the Organization

National Disaster Risk Reduction Management Commission (NDRRMC) is *an agency that is assigned to prepare and respond to natural calamities and human-induced emergencies*. NDRRMC³ were able to design a framework providing a *"comprehensive, all hazards, multi-sectoral, inter-agency and community-based approach to disaster risk reduction and management," (Republic Act 10121)*. This framework was integrated into a National Disaster Risk Reduction Management Plan (NDRRMP) created last June 2011.

NDRRMP is a plan that covers four (4) core aspects:

- Disaster Prevention and Mitigation
- Disaster Preparedness
- Disaster Response
- Disaster Rehabilitation and Recovery

National Disaster Risk Reduction Management Plan (NDRRMP)⁴ *is guided by good governance principle within the context of poverty alleviation and environmental protection*. NDRRMP is implemented by the Office of Civil Defence (OCD), under the Department of National Defence (DND).

B. Problem Statement

The group aims to solve the following challenges faced by NDRRMC:

- Lack of coordination within the agencies including the government and private donors which leads to inconsistency of support allocation and distribution of goods in the effecting areas.⁵
- Lack of accuracy in information sharing, which includes risk assessments, inventory, early warnings and other report needed in preparation of the support to the victims.⁶

³ NDRRMC, National Disaster Preparedness Plan 2015 – 2028, <http://lga.gov.ph/media/uploads/2/Publications%20PDF/Book/NDPP%20Vol%201.pdf>, p13

⁴ NDRRMC, <http://www.ndrrmc.gov.ph/>

⁵ GSMA, Designing an Effective Disaster Preparedness & Response Programme, <http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/Designing-an-Effective-Disaster-Preparedness-Response-Programme.pdf>, p12

⁶ United Nations, Progress and Challenges in the Disaster Risk Reduction (2014) http://www.unisdr.org/files/40967_40967progressandchallengesindisaste.pdf, p12



C. Project Scope

The scope of this project will only concentrate on NDRRMC's second part of the framework, Disaster Preparedness. For this paper the group had chosen earthquake disasters as a sample data.

D. Objectives

The project proposal aims to address the problems faced by the NDRRMC's Disaster Preparedness:

- To be able to increase the efficiency on consolidating resources of data in a single database
- To extract and obtain accurate and useful data with the help of data analytics.
- To proactively recognize disasters through the analytical report from the system and increase the lead-time in preparation for the disaster.

III. Project Proposal

A. Proposed System

After considering the *National Disaster Preparedness Plan 2015-2028 Volume 1* and SCM Principles, the team came up with a proposal of implementing a technology in order to address the challenges faced by NDRRMC Disaster Preparedness. This technology will also be supported by different systems that is connected into a Database Warehouse which has a BI Tool that will demonstrate complete historical records, dashboards and information needed by the response team.

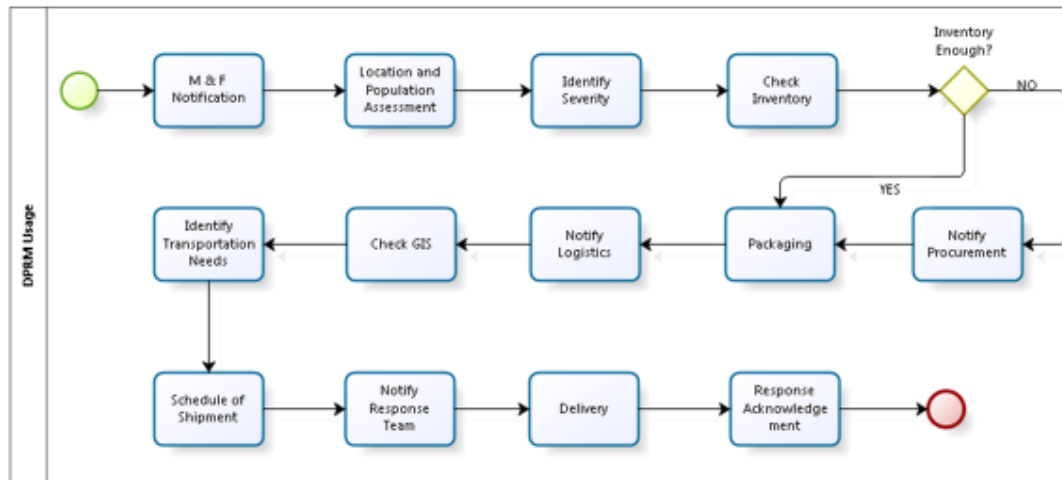
Datawarehouse High-level Diagram



In this diagram, there are five (5) independently working systems that has its own DB that will record transactions and activities per system. In between DRRM (Disaster Response Resource Management) Data Warehouse and the different systems there will be an ETL (Exact, Transform, Load) that will process and save and translate the data into an analytical report with the help of BI tool and be able to show dashboards as well as analytical reports for easy understanding on the current situation for every disaster.

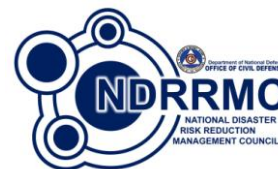
Applying the solution referencing to the concept in the Seven Principle of Supply Chain allow us to magnify the value of technology in Disaster Preparedness. The DRRM high level diagram will explain the connection of Supply Chain Management to Disaster Preparedness project proposal.

DRRM High Level Diagram



DRRM Diagram Details:

1. Start with information coming from Monitoring and Forecasting System to notify specific sectors / units for the possible disaster that will occur.
2. The BI Tool will show the status of location and current population in the area affected.
3. M & F will also provide the severity based on the information gathered by the office responsible like PAG-ASA and PHIVOLCS.
4. The BI Tool will show the current inventory and storage location of the goods, supplies and transportation means and will identify if its enough. In case not, the BI Tool will show the report and automatically send to Procurement.
5. The BI Tool will also give information about the Geographic Location of the area affected.
6. The BI Tool will give the list of Transportation means based on the GIS information to know the right vehicle to use in delivering the goods.
7. BI Tool will record all of this information and notify the Response Team for proper acceptance, preparation and distribution.



Samples of Datawarehouse Usage for Earthquake in different types of areas and community

To easily understand the propose system, the team agrees to relate it into one disaster happened last July 16, 1990 that impacts different types of area such as Urban, Coastal and Mountainous Area.

Disaster: The July 16, 1990 Luzon Earthquake @ 7.8 Magnitude

SCENARIO (AREA)	LOCATION	CASUALTIES	SUPPORT NEEDED
Mountainous Area	Baguio City	Dead – 1000+ Injured – 500+	Air Force
Coastal Area	Dagupan	Dead – 17+ Injured – 47+	Public Works
Urban Area	Cabanatuan	Dead – 152+ Injured – 274+	Public Works
	TOTAL	Estimated Infrastructure – 18.7B	

Problems Encountered:⁷

1. Failure of some local DCCs to react and take charge. Some local officials were caught unaware, resulting in the failure to take charge.
2. Lack of coordination between and among NDCC member agencies/NGOs especially in the allocation and distribution of relief goods resulting in the slow or non-delivery of assistance in affected areas. The NGO relief agencies did not seek the advise of the government regarding the relief requirements in the affected areas. They started to distribute their relief good on their own which sometimes resulted in the disproportionate distribution of relief goods.
3. Need for an effective quick response rescue/recovery capability. The rescue volunteers/teams who responded have very little capability except raw manpower.
4. Need for the pre-inventory of rescue capability of private firms and harnessing them for rescue/relief operations. The disaster revealed the inability of some DCCs to immediately provide local rescue equipment/tools to responding teams despite their availability in the community.
5. Lack of accurate knowledge of alternative routes to isolated areas, which prevented relief agencies of the government of the government and the NGOs from proceeding to the affected areas.

⁷ PHILVOLCS, The July 16 Luzon Earthquake,
http://www.phivolcs.dost.gov.ph/html/update_SOEPD/1990LuzonEQ_Monograph/pp239/pp241_249.html



6. Low level of public awareness and preparedness of Filipinos about geologic phenomena like earthquakes, volcanic activities, landslides, etc.
7. Need for back-up communications systems between affected areas and the RDCC and NDCC. Most often, during disasters of large magnitude, communications lines are cut off due to power failure which therefore necessitates back up communication systems powered by batteries or emergency generators.

Having all of this information from that Earthquake, the propose system will be able to help resolve the problems as a Datawarehouse with Business Intelligence Tool will be able to show dashboards with analyzed charts that will easily give information for what is needed and what is missing in order to perform a seamless preparation before and during a disaster.

Ideal Information of BI Tool for preparation;

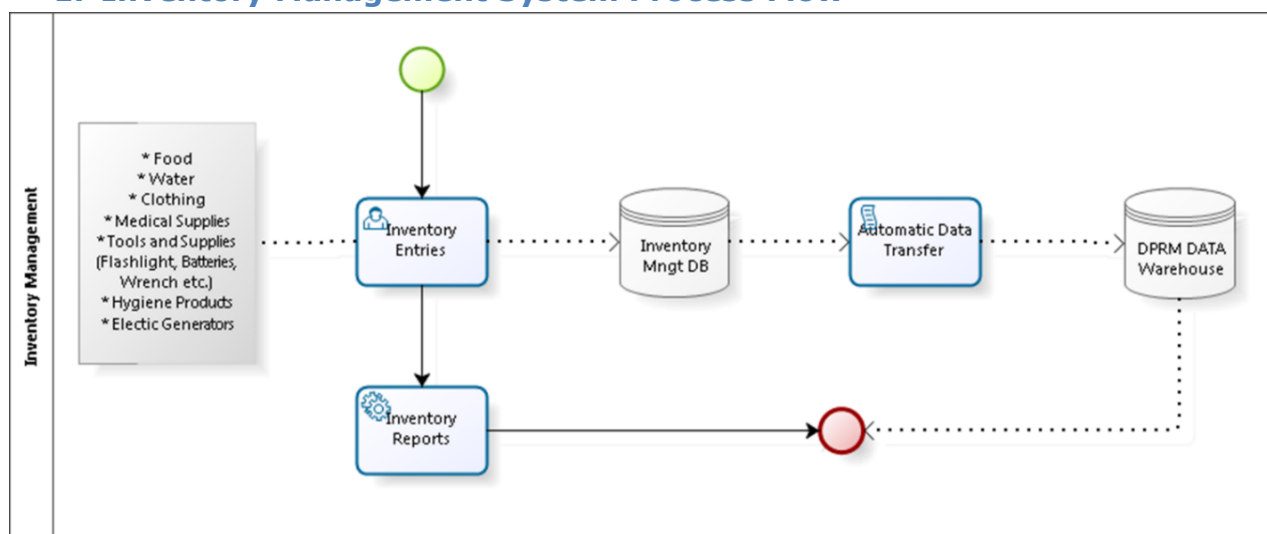
1. BI Tool will show the current inventory of goods needed in preparation and the data is coming from the Inventory Management System
2. BI Tool will show transportation details and warehouse location from the data entries in Logistic System
3. BI Tool will show wather forecast, probability of earthquakes and other disaster probability information coming from the entries in Monitoring and Forecasting System
4. BI Tool will show available funds and historical purchase data in case there is a need to purchase additional goods and services to prepare for disaster which came from Procurement System
5. BI Tool will show information of the situation on the affected area in order for the preparation and response team seamlessly plan to deliver the goods and services to the targeted area. This information is coming from the GIS System.

The Five System from this ideal information will be available for entries from the different sectors that we have identified thru our research;

SYSTEM	OBJECTIVE	Agency	DATA
Inventory Management	<ul style="list-style-type: none"> * Demand and Supply * Assessment Capacity * Cataloguing the Tools 	DSWD BDRRMC DOH	<ul style="list-style-type: none"> * Food, Water and Clothing * Medical Supplies * Tools and Supplies (Flashlight, Batteries, Wrench etc.) * Hygiene Products * Electric Generators
Logistics System	<ul style="list-style-type: none"> * Rapid Response * Sustenance and Support * Transport * Coordination and Collaboration * Understanding Environment * Packaging of Commodities * Security 	AFP BFP / DILG-BFP PNP BJMP DPWH DILG	<ul style="list-style-type: none"> * Manpower - Security * Transportation * Transport Infrastructure * Communication Lines * Building Codes * Storage
Monitoring and Forecast System	Monitoring * Area Status * Delivery Forecast * Upcoming Disasters * Early Warning	CCC PAGASA PhilVolcs DENR DOST LDRRMC NDRRMOC NRCP	<ul style="list-style-type: none"> * Weather Forecast * Water Levels * Health Hazard * Risk Maps * Environmental Condition (Volcano, Earthquake, Tsunami, War) * List of Affected Areas * Treatment and Guidelines
Procurement Systems	<ul style="list-style-type: none"> * Budget and Control * Sources of Supply 	BLGD COA DBM	<ul style="list-style-type: none"> * Local Purchase * Import Fund * Donation Fund * Loans
GIS - Geographic Information System	<ul style="list-style-type: none"> * Provide over-all location situation 	PhilVolcs DENR DICT	Geographical Data - Slope and Aspect - Geometric Networks - Map Overlay - Graphic Display

To fully understand the Five Systems that is feeding the Datawarehouse, below is the detailed illustration and definition per system.

1. Inventory Management System Process Flow



The **Inventory Management System** for Disaster Preparedness is designed to record the current stocks, orders and deliveries of Foods, Water, Clothing, Medical Supplies, Tools and Supplies (Flashlight, Batteries, Whistle, etc.) and other supplies that are needed during disaster by the Response Team.

The Key Information that expected to be available in Inventory Management System:

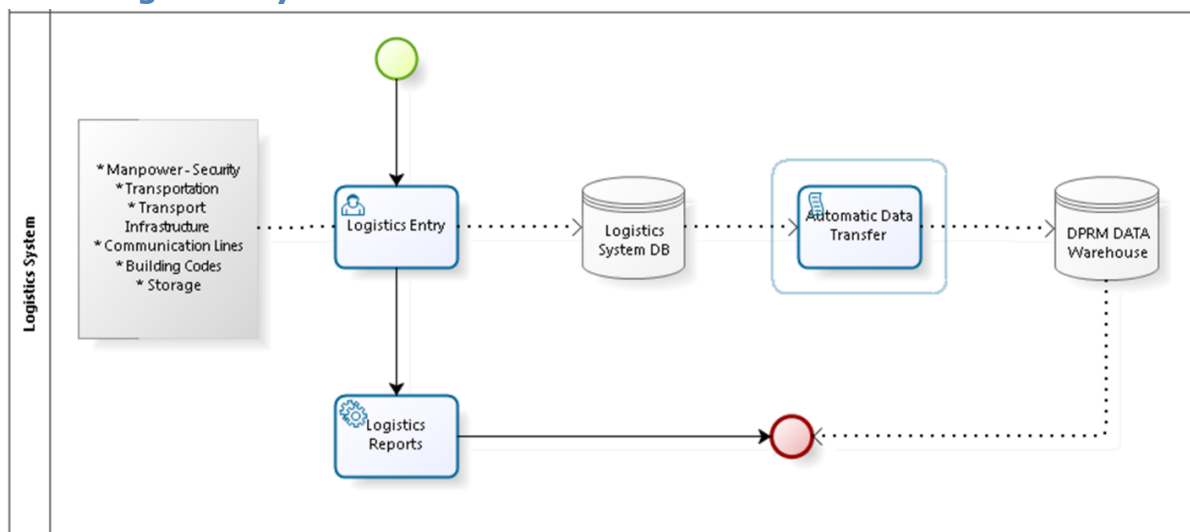
1. Current Inventory of goods
2. Received goods and supplies
3. Delivered goods
4. Reports about Stocks, Orders, Receivable and Deliveries

For example, DSWD as one of the main sector will generate data from the Inventory System. The following processes listed below are the proposed process flow on how personnel from DSWD will use and generate the system once the goods are received:

1. DSWD personnel will log-in to the system
2. DSWD personnel will check the condition of goods for quality control
3. DSWD personnel will enter the information of the item received in to the system based on the receiving document like Order Document and Delivery Notes.
4. Lastly, another personnel from DSWD will receive and enter the description, quantity, expiration date, etc. of the supplies received

After completing these steps, all information will be recorded into Inventory Management System DB which will automatically push records into the NDRRMC Data Warehouse.

2. Logistics System

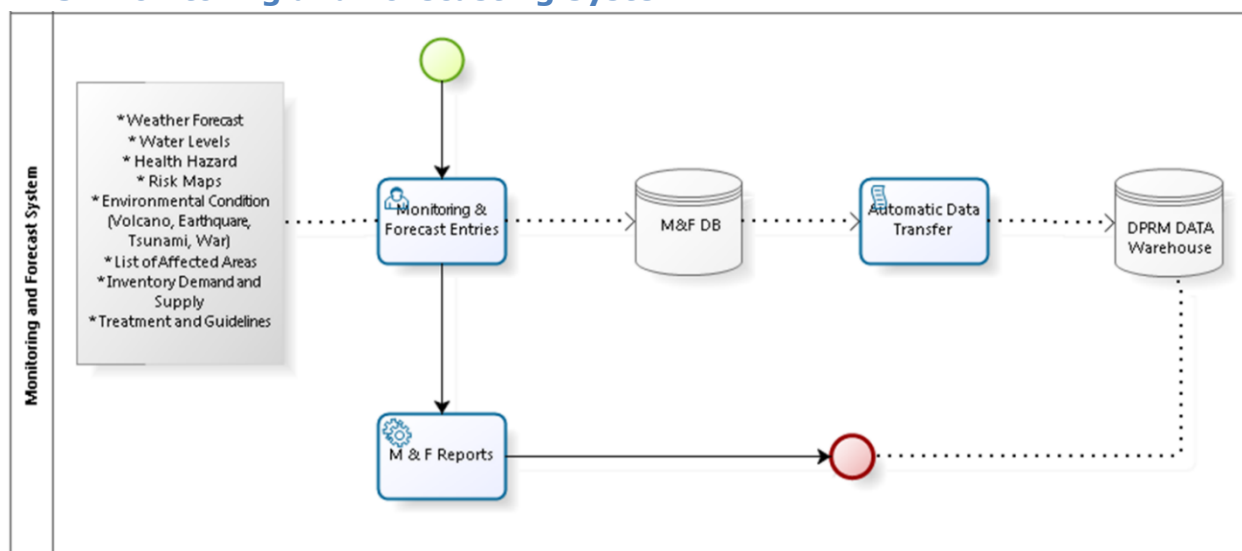


The Logistics System for Disaster Preparedness is designed to record all data that covers Manpower-Security, Transportation, Transport Infrastructure, Communication Lines, Building Codes and Storage of goods to ensure the sustenance and support of Response Team in facing the disaster.

Key information that will be available in Logistics System:

1. Deployment records of Manpower per disaster
2. Transportation records to use in delivering the goods and services
3. Records of Infrastructure for efficient delivery
4. Records of all communication lines
5. Storage and Building codes where the goods and services are located

3. Monitoring and Forecasting System

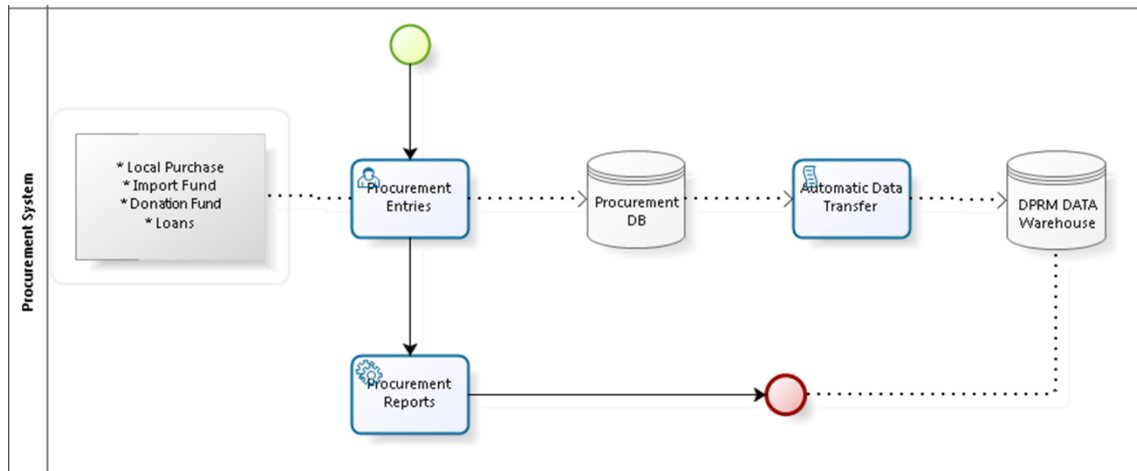


The Monitoring and Forecast System for Disaster Preparedness is designed to acquire visibility of Weather Forecast, Water level, Health Hazard, Risk Maps, Environmental Condition, List of affected areas, Inventory Demand and Supply and Treatment and Guidelines. This system will ensure the safety of goods and delivery of service by monitoring the status of area and also have an early warning to the community before the disaster happens.

Key information that will be available in Monitoring and Forecast System:

1. Weather Forecast to identify the disaster criticality
2. Water levels in case of possible flooding
3. Health Hazard probability and information
4. Maps and other area information
5. Reports of available supply and possible demand based on current area population
6. Treatment and Guidelines

4. Procurement System

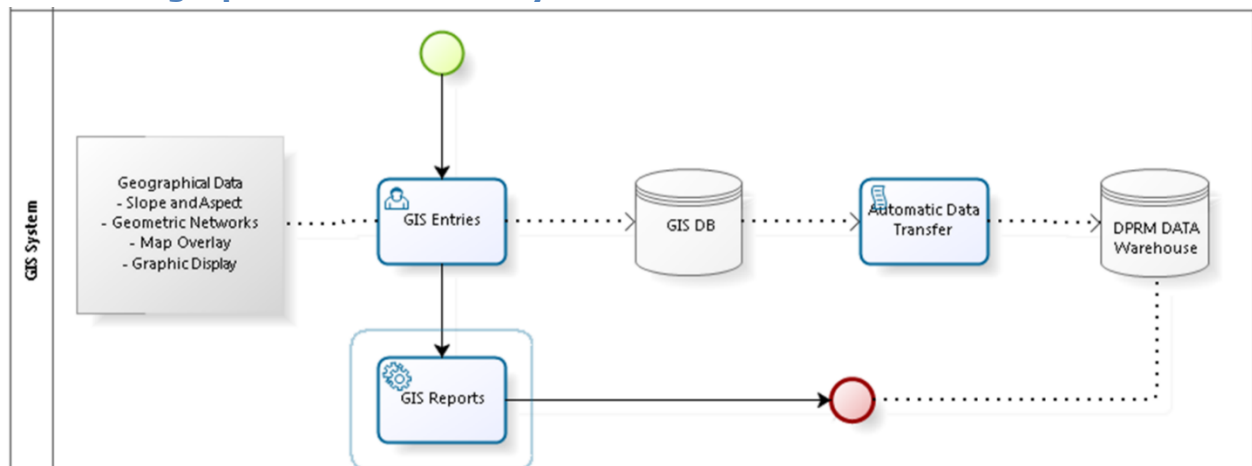


The Procurement System for Disaster Preparedness is designed to have visibility of how the department or different sectors purchase the goods and services required in Disaster Preparations.

Key information that will be available in Procurement System are;

- Local Purchase of local goods and services
- Import Fund information
- Donation Fund information
- Loans

5. Geographic Information System



The **Geographical Information System (GIS)**⁸ for Disaster Preparedness is designed to store data different area and locations in the Philippines to help the Disaster Preparedness and Response Team analyze and understand the area affected by disaster.

Key information that will be available in Procurement Systems are;

- Geographical Area such as Slope and Aspect
- Map overlay to easily analyze the location
- Graphic Display or pictures for easy understanding of situation for the affected area

⁸ Wikipedia, https://en.wikipedia.org/wiki/Geographic_information_system

B. Proposed BI Tools

Big data refers to extremely large data structured or unstructured⁹ that helps organizations or entities in critical decision making¹⁰. Combined with analytics, it leads to more effective marketing, better customer service and improved operational efficiency¹¹ among others.

Businesses have been using big data to improve operations for some time now and disaster response teams are slowly adapting big data and data analytics in disaster management – in providing appropriate and timely responses¹², and using vital information to help minimize damages caused by disasters^{13 14}.

While not much can be done in preventing natural disasters, big data and analytics can play a crucial role in preparation, response and recovery, e.g. predicting earthquakes with up to 90% accuracy¹⁵. Social media and tech giants such as Google and Facebook, with their massive mine of data also played a major role, e.g. as demonstrated in the Nepal quake when they launch the People Finder and Safety Check systems used to track their loved ones.^{16 17}

The Disaster Response Resource Management Data Warehouse (DRRMDW) suggests an end to end solution covering the four phases of big data value chain – Data generation, acquisition, storage and analysis¹⁸ providing real-time and critical data in times of disaster.

Among the numbers of available solutions for data warehousing, we have identified two methods of implementation - one by setting up a physical (on-site) infrastructure and the other by taking advantage of the Cloud. Here are two of the most common platforms showing each implementation which the Disaster Response Resource Management Data Warehouse (DRRMDW) can adopt:

⁹ Big data

http://searchcloudcomputing.techtarget.com/definition/big-data-Big-Data_1

¹⁰ What is Big Data, Jennifer Dutcher <https://datascience.berkeley.edu/what-is-big-data/>

¹¹ Techtarget, Big Data Analytics <http://searchbusinessanalytics.techtarget.com/definition/big-data-analytics>

¹² Big Data's Role in Crisis Response and Recovery

<https://datafloq.com/read/Big-Data-Role-Crisis-Response-Recovery/1581>

¹³ Big Data Approaches Disaster Response

<https://datafloq.com/read/big-data-approaches-disaster-response/1000>

¹⁴ Nepal Earthquake using Big Data in a Crisis

<http://www.forbes.com/sites/bernardmarr/2015/04/28/nepal-earthquake-using-big-data-in-a-crisis/#5da630da532f>

¹⁵ Nepal Earthquake using Big Data in a Crisis

<http://www.forbes.com/sites/bernardmarr/2015/04/28/nepal-earthquake-using-big-data-in-a-crisis/#5da630da532f>

¹⁶ Nepal Earthquake using Big Data in a Crisis

<http://www.forbes.com/sites/bernardmarr/2015/04/28/nepal-earthquake-using-big-data-in-a-crisis/#5da630da532f>

¹⁷ Big Data Role Crisis Response and Recover

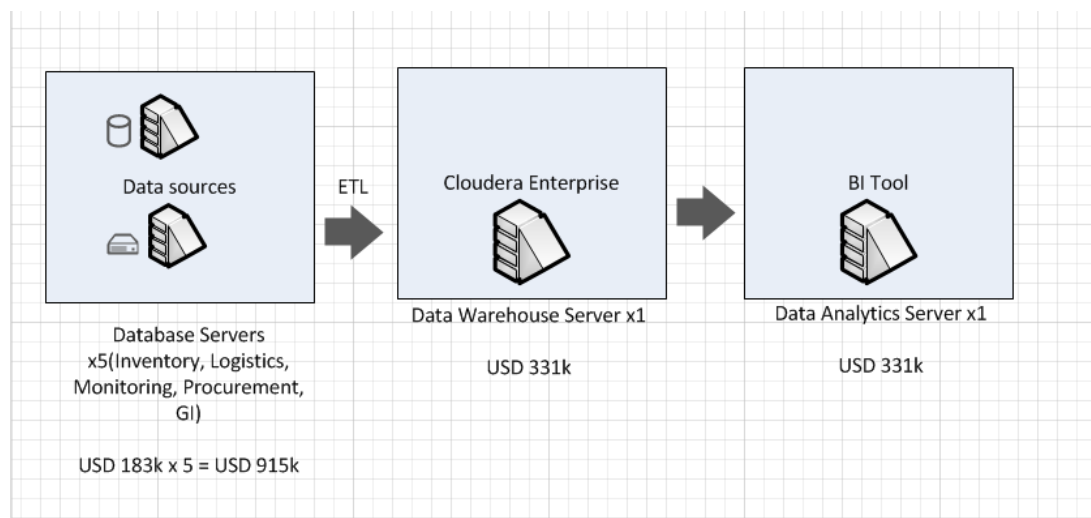
<https://datafloq.com/read/Big-Data-Role-Crisis-Response-Recovery/1581>

¹⁸ Nepal Earthquake using Big Data in a Crisis

<http://www.forbes.com/sites/bernardmarr/2015/04/28/nepal-earthquake-using-big-data-in-a-crisis/#5da630da532f>

1. BI Infrastructure (with Cloudera Enterprise)

Powered by Apache Hadoop and built for mission-critical environments, Cloudera provides a cohesive platform for data processing and big data analytics.¹⁹



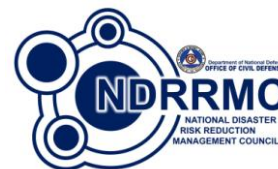
2. IBM Watson Analytics (Professional)

The IBM Watson Analytics is a cloud-based smart data analysis and visualization service that features accessible (basic to advanced) analytics and a comprehensive dashboard with infographic. IBM Watson Analytics has pre-built solutions for a number of industries including the government sector.²⁰

Features	1 or more users 100 GB of storage Access to relational databases and 19 data connectors Access to IBM Analytics Exchange
Pricing	Starts at USD 80 per month

¹⁹ Cloudera
<http://www.cloudera.com/products.html>

²⁰ IBM, Watson Analytics
<https://www.ibm.com/analytics/watson-analytics/us-en/>



IV. Project Glossary

A. Key Terms

- **Disaster Preparedness**²¹ refers to measures taken to prepare for and reduce the effects of disasters. That is, to predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences.
- **Inventory Management**²² - *is the practice overseeing and controlling of the ordering, storage and use of components that a company uses in the production of the items it sells.*
- **Logistics Management**²³ - *Application of management principles to logistics operations for efficient and cost effective movement of goods and personnel.*
- **Procurement Management**²⁴ - *is the practice of planning and directing the activities of purchasing agents who buy materials needed for the operations of a company or organization. Procurement management also involves oversight of the supplier evaluation and purchase negotiation process.*
- **Data Warehouse**²⁵ - *collection of corporate information and data derived from operational systems and external data sources.*
- **ETL or extract, transform, load**²⁶ *is the process of migrating data from one database to another. It also includes data format conversion e.g. reading flat file or xml data and loading them to the target database.*
- **IBM Watson Analytics**²⁷ *is an advanced analytics tool taking advantage of IBM's cognitive technology which includes use of plain English text as commands or inputs, among its many features.*

B. Acronyms

- **NDRRMC** – National Disaster Risk Reduction Management Council
- **NDRRMP** – National Disaster Risk Reduction Management Plan
- **SCM** – Supply Chain Management
- **BI** – Business Intelligence
- **OCD** – Office of Civil Defence
- **DND** – Department of National Defence
- **ETL** – Extract, Transform, Load
- **DRRM** – Disaster Response Resource Management
- **GIS** – Geographical Information System

²¹ International Federation of Red Cross, Preparing for Disasters: <http://www.ifrc.org/en/what-we-do/disaster-management/preparing-for-disaster/>

²² Investopedia, <http://www.investopedia.com/terms/i/inventory-management.asp>

²³ Business Dictionary, <http://www.businessdictionary.com/definition/logistics-management.html>

²⁴ Reference, Business & Finance, <https://www.reference.com/business-finance/procurement-management-a668ccef4a9fb187>

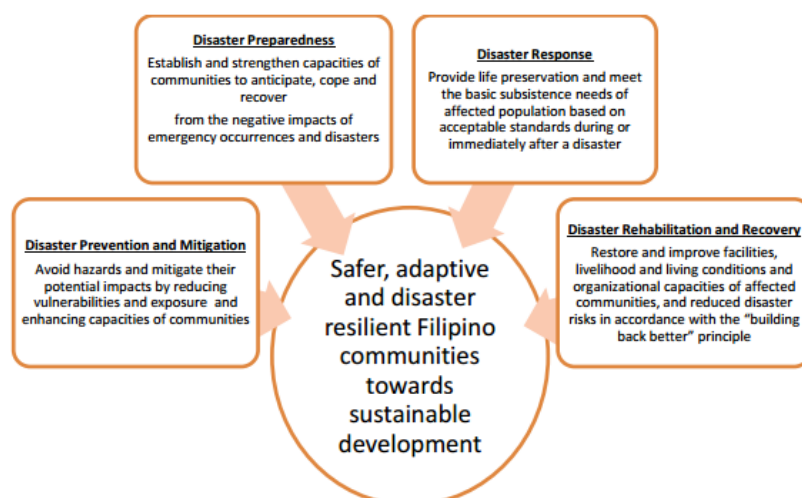
²⁵ Techopedia, <https://www.techopedia.com/definition/1184/data-warehouse-dw>

²⁶ Oracle, Database Data Warehousing Guide, https://docs.oracle.com/cd/B19306_01/server.102/b14223/etlover.htm

²⁷ IBM, <http://research.ibm.com/cognitive-computing/>

V. Appendices/

- Figure 1.0 : NDRRMP Framework²⁸



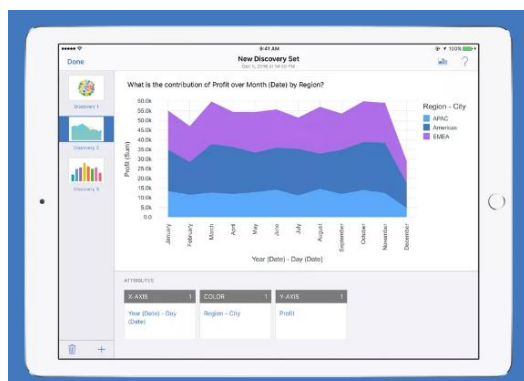
- Figure 2.0 : Disaster Preparedness²⁹

Overall responsible agency: Department of Interior and Local Government (DILG)

Outcome	Lead agency(ies)
7. Increased level of awareness and enhanced capacity of the community to the threats and impacts of all hazards	Philippine Information Agency (PIA)
8. Communities are equipped with necessary skills and capability to cope with the impacts of disasters	Department of Interior and Local Government (to coordinate) and OCD (to implement)
9. Increased DRRM and CCA capacity of Local DRRM Councils, Offices and Operation Centers at all levels	DILG
10. Developed and implemented comprehensive national and local preparedness and response policies, plans, and systems	DILG and OCD
11. Strengthened partnership and coordination among all key players and stakeholders	DILG

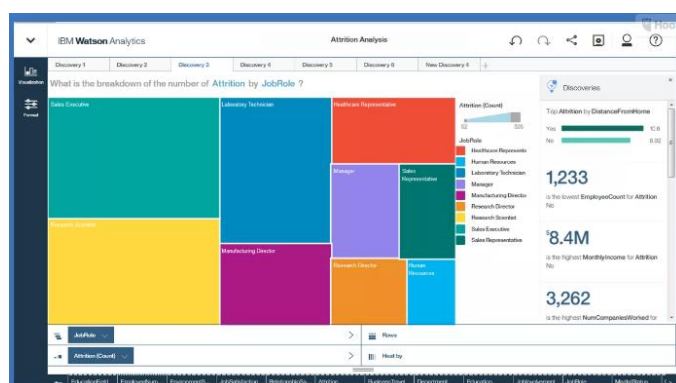
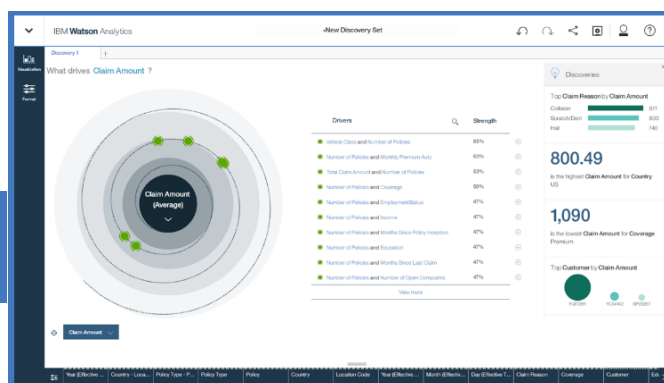
^{28,29} NDRRMC, National Disaster Risk Reduction Management Plan (NDRRMP) 2011-2028, http://www.ndrrmc.gov.ph/attachments/article/41/NDRRM_Plan_2011-2028.pdf

- Figure 3.0 : IBM Watson Analytics Key Features³⁰



Natural language dialogue
Engage with your data conversationally and discover new associations and insights. All you need is a desktop web browser or the mobile app for iPad.

Automated predictive analytics
Automatically surface what is likely driving outcomes.



One-click analysis
Make sense of data discoveries in one click with automatic visualizations you can use in dashboards to tell more powerful stories.

³⁰ IBM, <https://www.ibm.com/us-en/marketplace/watson-analytics#product-header-top>



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