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Challenges of Typhoons in ICT: Is it a Risk to Economy?

Las Johansen B. Caluza*

Leyte Normal University, Philippines; lasjohansencaluza@gmail.com

Abstract

This study explored and theorized the significant effects of typhoons relative to ICT products and services in the economy of a country that is most visited by this kind of catastrophe. Anent to this, the availability of information in the cloud such as economic indicator relative to ICT from the World Bank Organization (WBO) website and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) was exploited through data mining, specifically cluster analysis to in-depth the data analysis and generate a theory based on facts through dendrogram, amalgamation steps, and observation by cluster centroids. As a result based on the generated data using the cluster analysis, having three (3) clusters with twelve observations, it was speculated that there was a rise of ICT products and services even if the country where most visited by typhoons. This implies that ICT investment in the Philippines will continuously gain since it was not affected by this catastrophe. Hence, this negates some speculations that the ICT economy will be affected by this catastrophe. Finally, it was theorized that a country that is most visited by typhoons does not affect the economic growth relative to ICT products and services.

Keywords: Climate Change, Cluster Analysis, Economy, Information and Communication Technology, Typhoon

1. Introduction

Climate change is the world's primary concern nowadays. The United Nation has identified as climate change is happening now, it affects people's lives and is disrupting national economies and costing us today and tomorrow as reported in the UN Climate Summit 2014[9]. According to Union of Concerned Scientists (ND), global warming effects around the world specifically on its identified impacts were costs such as damage to property and infrastructure, lost productivity, mass migration and security threat. In a recent report, it emphasizes that scientists who gathered in Japan finalized in the Intergovernmental Panel on Climate Change (IPCC) reported that climate change impacts and vulnerabilities called such economic estimates as "difficult" to make. The closest they came to an overall number was to say that aggregate losses across the world economy have a more than fifty percent (50%) chance of being greater than two percent (2%) of global Gross Domestic Product (GDP). They also noted that in most economic sectors, the impacts of climate change would be smaller than the impacts of population and technology change[3].

The Philippines is the world's 40th largest country in terms of Gross Domestic Product (GDP) and experience typhoons regularly. Each typhoon season costs the country, 2% of its GDP from lost crops and productivity, and an additional 2% of reconstruction costs, according to estimates from Naderev Madla Sano, the country's climate change commissioner[1]. And the Philippines is also the worlds most visited by typhoons. In a United Nations (UN) report, climate change is a threat to economic growth[6]. In the Philippines, every aftermath of a typhoon is expected that there is a great impact on the economy and trades1, further, since the typhoon, the country's domestic currency weakens (Philippine Peso) by 0.3% against

*Author for correspondence

the United States Dollar (USD). In November, 2013 alone the value of the Philippine Peso weakened to 0.9% against the USD. This indicator alone is a sample of the impact of typhoons in the Philippines. Production of electronics in

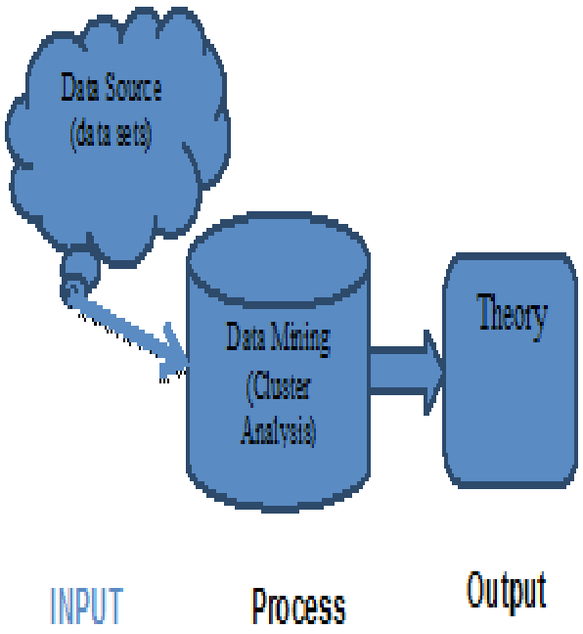

Figure 1. Conceptual framework of the study.

relation to total global electronics industry accounts for about 2%, according to Birmiwal[1]. Further outsourcing services were also affected every time a calamity occurs in a particular city such as Cebu and Iloilo.

2. Conceptual Framework

This study was anchored on the Data Mining and Knowledge Discovery theory (DMKD). According to Springer Verlag of ReseachGate "advances in data gathering, storage and distribution have created a need for computational tools and techniques to aid in data analysis". DMKD builds on techniques and theories from many fields, including statistics databases, pattern recognition and learning data visualization uncertainty modelling data warehousing and Online Analytical Processing optimization and high performance computing[4].

Input-process-output approach was utilized in this study in determining, processing, and developing new information. Information relative to climate change, specifically typhoons that visited or enter the Philippine Area of Responsibility (PAR) and ICT products and services are taken from the cloud or the internet. Data mining, specifically cluster analysis approach was used to process the raw data into a refined data resulting in a theoretic development (Figure 1).

3. Research Design and Methods

3.1 Research Design

The research design used by the research was the quantitative design, wherein the data obtained from the source file through data sets from the cloud were tested and verified to generate new information.

3.2 Research Methods

The data used by the researcher were obtained from the cloud through mining the data that were substantial, complex, and related information relative to climate change and ICT products and services. Data sets such as typhoons that enters the PAR were coming from the Department of Science and Technology, specifically the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGSA), whereas data sets related to ICT products and services in the Philippines were coming from the World Bank Organization website. Data mining is a statistical procedure for exploring data sets and for formulating theories which may be hidden in the mass of information[5]. In this study, data mining was employed through Cluster analysis to determine the similarity or relativity of complex and big data. In a lecture of Stefanowski[7] he defined clustering as to finds "natural" grouping of instances given un-labeled data. Further, a cluster is a subset of objects which are "similar", a subset of objects such that the distance between any two objects in the cluster is less than the distance between any object in the cluster and any object not located inside it, and a connected region of a multidimensional space containing a relatively high density of objects.

Data sets were carefully processed and analyzed through Cluster Analysis using software called Mini Tab 13.20 version. Data obtained from year 2001 to 2012 such as the number of typhoons, ICT services exports, ICT goods exports, ICT goods imports, internet users, fixed broadband internet subscribers, mobile cellular subscriptions, telephone lines, and secured internet servers were input into the software. The output that was generated was dendrogram, amalgamation, and cluster centroids.

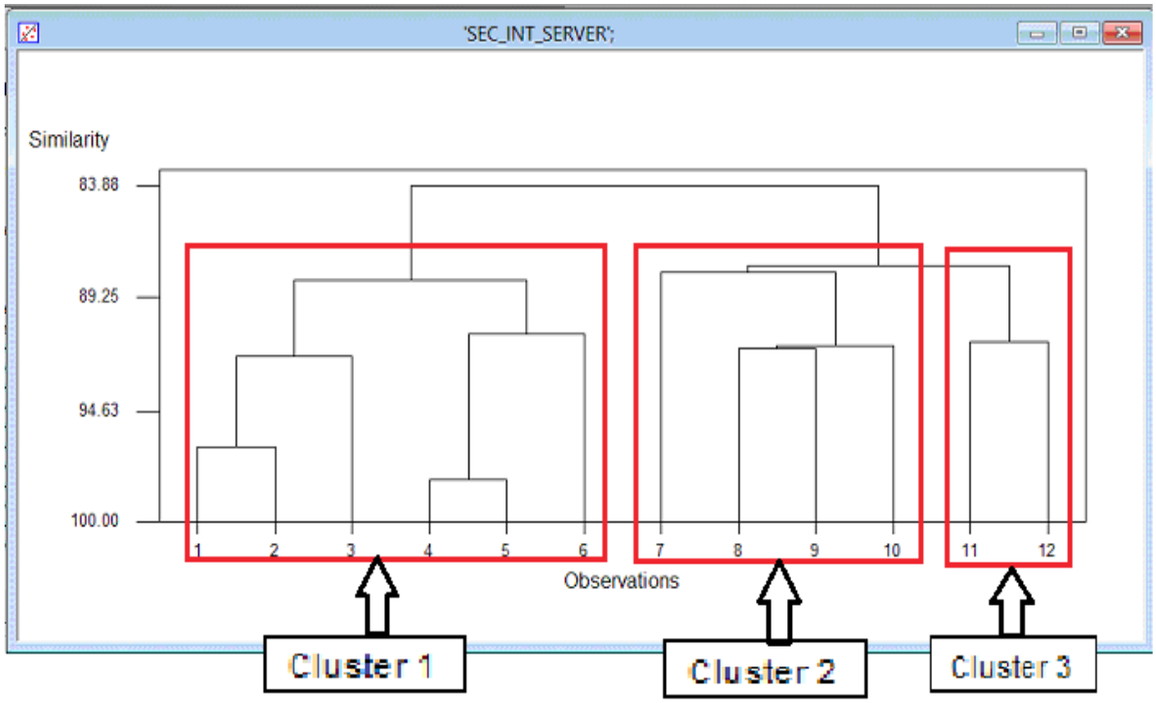

Figure 2. Dendrogram: observations by clustering.

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Welcome to Minitab, press F1 for help.

Cluster Analysis of Observations: TYPHOON, SERV_EXPORTS, GOODS_EXPORT, GOODS_IMP

Euclidean Distance, Single Linkage

Amalgamation Steps

Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	11	97.95	1.8448E+06	4	5	4	2
2	10	96.41	3.2239E+06	1	2	1	2
3	9	92.07	7.1267E+06	1	3	1	3
4	8	91.65	7.5001E+06	8	9	8	2
5	7	91.54	7.6020E+06	8	10	8	3
6	6	91.32	7.7969E+06	11	12	11	2
7	5	90.99	8.0955E+06	4	6	4	3
8	4	88.39	1.0427E+07	1	4	1	6
9	3	87.99	1.0787E+07	7	8	7	4
10	2	87.71	1.1042E+07	7	11	7	6
11	1	83.88	1.4481E+07	1	7	1	12

Figure 3. Amalgamation steps.

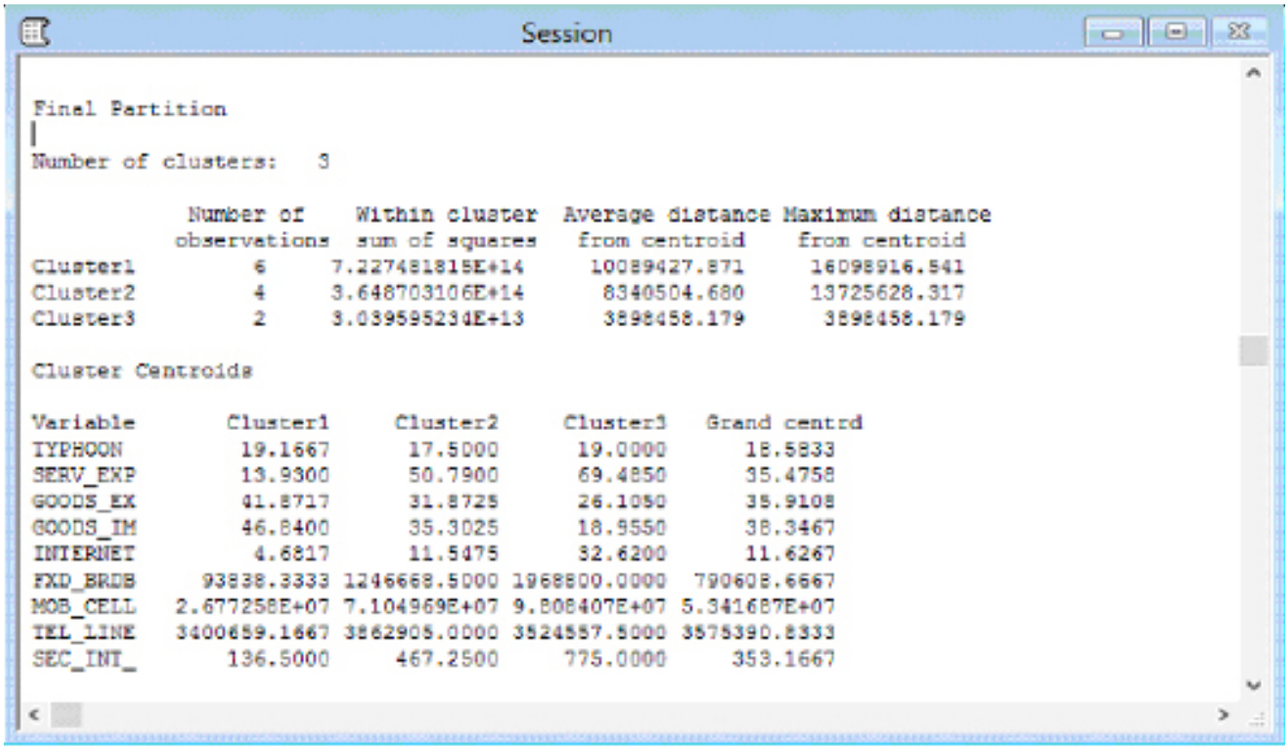

Figure 4. Observations by cluster centroids.

4. Results and Discussions

Figure 2-4 show the observations using clustering analysis. The dendrogram shown in Figure 2 was the groupings by cluster based on the Euclidean distance in single linkage. Figure 3 was amalgamation steps on how the observations were grouped according to their similarity level, distance level and cluster joined. Moreover, Figure 4 illustrates the number of clusters of the observations naming as cluster 1, cluster 2, and cluster 3 wherein cluster 1 has six (6) number of observations as revealed in dendrogram, its observations one (1) to six (6), cluster 2 has four (4) such as observations seven (7) to ten (10), and lastly cluster 3 which has only two (2) number of observations such as eleven (11) and twelve (12).

5. Interpretation

The clustering of ICT products in the Philippines is mainly to determine the trend of the products relative to typhoons. Cluster 3 is the most trending ICT products relative to typhoons while Cluster 2 is the last performer in the movement of ICT products relative to typhoons.

Further, Cluster 1 shows an increase of typhoons that visited the Philippine Area of Responsibity, ICT Goods Exports, ICT Goods Import; whereas Cluster 3 has a little off below cluster 1 in terms of the increase of typhoon that visited the Philippine Area of Responsibity, but an extreme increase in Internet Subscription, Fixed Broadband Subscription, Mobile Cellular Subscription, and more Secured Internet Servers over the other clusters; lastly Cluster 3 is the least among the three clusters because it is only associated with an increase of Telephone Line Connection over the others.

6. Theory

A country that is most visited by typhoons does not affect the economic growth relative to Information and Communication Technology (ICT) products and Services.

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