# BUSSINESS INTERRUPTION: A FINANCIAL SCOPE


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**SUMMARY:**

The present study aims to present the financial impact on the evaluation of seismic protection projects, studying two directions: the direct cost (rehabilitation) and indirect costs (costs caused by business interruption with results such as loss of market) for assessing the seismic dissipation systems Engineering Professional of the financial elements have more impact full business cases to justify the use of seismic energy dissipation elements, considered as expensive, because it only checks the repair costs of damaged structures without taking into account the costs of the impact of not having the structures in the different business developments, consider and evaluate issues such as loss of market, lack of attention to demand entry of other competitors in home markets and so on.

The study is based on the impacts presented in the Chilean beer system during the earthquake of Chile in 2010, and its financial impacts presented to date, measuring financial impact on the Chilean beer market mainly by comparing the business case before the financial impact and after the event to compare sub-topics to be evaluated and resulted in the non-approval of projects for the installation of energy-dissipating elements and actual costs after the impact.

The idea is to offer practitioners and academics of Earthquake Engineering, elements of study approach to better substantiate the "Business Case" (Business Cases) from a financial standpoint for the proper evaluation of preventive systems natural and anthropogenic disasters in today's businesses for a more accurate decision making to these events.

*Keywords: financial, dissipation, isolators, business, dampers*

## 1. INTRODUCTION

In studies performed when it is reinforcement or a project from seismic-resistant design, usually the study of financial recovery (commonly called "Business Case"), is crucial for making investment decision, and the initial cost of building or strengthening, must have a reasonable period of return (ROI), and an attractive interest rate (IRR), paid to the investment. Current methods are Net Present Value (NPV), Real Options (RO) or Probabilistic Risk Scenarios (@ Risk), are often used for this purpose.

The Business Case is a comparative table of income and expenses of the project during the operation, comparing and evaluating the project costs with the cost or risk of not carrying out the project. In these instances, the actions involved in an accidental business case, contain the cost of risk when it occurs, when present, and multiplied by a percentage of the probability of being present in the study period, financial case of recovery, typically 10 years in most companies. Normally in this assessment of the

cost, it is contemplated the costs to repair and replace structural and architectural elements damaged, but does not include the costs of not continue producing or supplying the service required by the market in question. These indirect costs should be taken into account to the appraisal.

This article aims to present a risk verification methodology that includes the cost of "Business Interruption", which ultimately affects the productive projects and to create a different perspective on the need for more comprehensive scenarios of decision making and the economic importance of the structures are fitted with seismic energy dissipation, either as buffers or sinks, even in non-structural components, which to a fault, do not allow normal operation of the building, causing an interruption in this Business process.

### 1.1. Statement of the Problem

It analyzes the impacts suffered by the United Breweries during the Chilean earthquake of Chile in 2010 and their financial implications submitted to date, measuring financial impacts on the Chilean beer market mainly to compare the business case before the earthquake and the actual costs repair to their respective economic impact assessment afterwards. This comparison highlights the sub-topics assessed prior to the devastating seismic event, which resulted in the failure to approve the proposed installation of energy-dissipating properties of these brewers.

### 1.2. Objectives and Scope

This work is devoted to analyzing the financial impact on the use of protective devices seismic energy dissipation systems, to minimize disruption of production processes of firms to extraordinary seismic events, considering two main aspects: the direct cost (the rehabilitation itself) and indirect costs (generated by the interruption of business), so that the engineers have financial assessment elements to justify its use. In practice, usually, to do the rehabilitation of a structural system you opt for lower cost option without considering the impact generated by the interruption of business, generated by a poor performance of buildings, such as: loss of market, lack of attention to demand entry of other competitors in home markets, among others.

We conclude presenting, among other things, it is important to offer to professionals and academics from the Earthquake Engineering, the use of concepts based on "Business Case" (Business Cases) to support better, from a financial standpoint, employment benefits of seismic protection systems in buildings of today's enterprises to reduce economic losses associated with business interruption.

## 2. BUSSINES INTERRUPTION: THE CASE OF THE CHILEAN BREWERS

We study the results observed from the experiences of CCU, recovery and impact on specific market beers in Chile.

### 2.1. Earthquake in Chile

At 3.30 am on the morning of February 27, 2010 an earthquake of 8.8 magnitudes on the Richter scale with epicenter at 110 km NNW of Chillán, Ñuble Province, VIII Region of Santiago, Chile. The epicenter of the event is located at coordinates 35,846 and 72,719 ° latitude longitude ° W, focal depth about 35 km.

The quake was invaluable impact on the regions most affected as Maule and Biobío, both for cities and communities in the valleys to the coastal towns that were hit by a strong tsunami occurred 30 minutes after the main event.

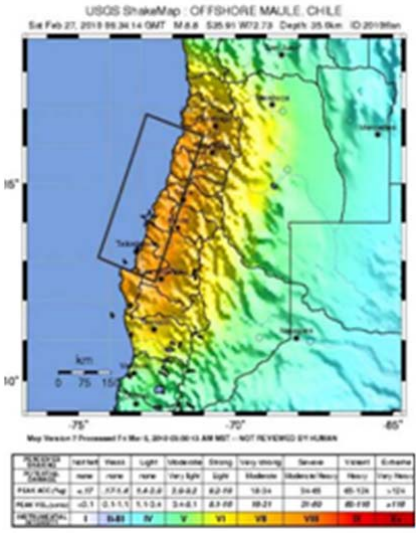


**Figure 1.-** Intensity map of the earthquake**.**

The earthquake was felt over a wide area; the instrumental intensity map (USGS, 2010) is presented in Figure (1):

*2.1.1. Characteristics of earthquake*

Following the main event continued seismic activity in the region in figure (2) shows the distribution of the number of replicates per day (Barrientos, 2010). Is necessary, to indicate that the first day the number of replicates is less than the second by problems of lack of electrical energy in the seismic network that could not operate under appropriate conditions.

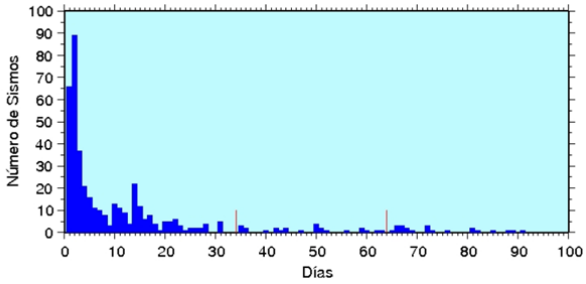


**Figure 2.-** Distribution by number of aftershocks**.**

Grouping by size replicas can determine the distribution shown in Figure (2) (Barrientos, 2010). Despite significantly reduce the number of events with the passage of time, some reaching magnitudes greater than 6 degrees.

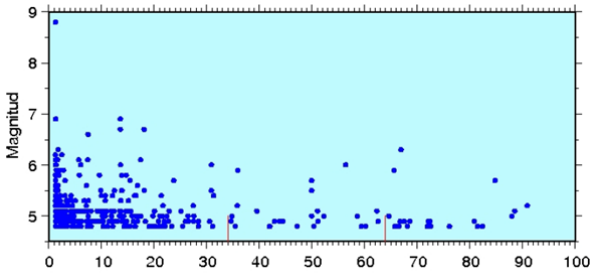


**Figure 3.-** Intensity distribution of aftershocks

The maximum accelerations recorded at different stations of the Chilean National Seismological Network, are presented in Table (1) (Barrientos, 2010). The nearest stations to the epicenter show the highest levels of accelerations reaching the highest recorded are 0.65 g.

**Table 1.1.** Maximum accelerations in different station

| Locality | High acceleration. Horizontal NS (g) | High acceleration. Horizontal EW (g) | High acceleration. Vertical (g) |
|---|---|---|---|
| Colegio San Pedro, Concepción | 0.65 | 0.61 | 0.58 |
| Cerro Calán, Santiago | 0.20 | 0.23 | 0.11 |
| Campus Antumapu, Santiago | 0.23 | 0.27 | 0.17 |
| Cerro El Roble | 0.19 | 0.13 | 0.11 |
| Melipilla | 0.57 | 0.78 | 0.39 |
| Olmué | 0.35 | 0.25 | 0.15 |
| Casablanca | 0.29 | 0.33 | 0.23 |
| San José de Maipo | 0.47 | 0.48 | 0.24 |
| Colegio Las Américas | 0.31 | 0.23 | 0.16 |
| Cerro Santa Lucia | 0.24 | 0.34 | 0.24 |

### 2.2. Damage to the Chilean Brewery

In recent years, Chile supply chain (Supply Chain) operating systems increasingly efficient through the concept of maintaining low inventory levels and stock.

In this context, and based on lower costs, the amount of purchased inputs or level of production and storage of products in many companies are defined based on demand, following a trend that has been successful worldwide. With a system based on software that help in this type of planning, measuring historical usage and behavior on special demand, companies have put aside the traditional warehouses to make way for modern distribution centers, managed with technology end.

However, after the earthquake of February 27, something in the supply chain failed and shortages of certain products in grocery stores put into question its effectiveness.

In recent years, we have also developed regulations and Structural Design techniques that seek to avoid not only the collapse of the structure, but to prevent damage to absorb energy inelastic without deforming or affect the operation of the facility, but studies project evaluation investment to allow the use of these systems seismic energy dissipation have been performed conventionally with a narrow focus, which does not allow the investment to be profitable for businesses.

The company studied in this case is United Breweries Chilean, which had an impact with the earthquake in Chile on February 27, 2010, at 3:34 am local time, with a magnitude of 8.8 degrees on Richter scale, and suffered minor damage to the operating unit, but the impact on its operations had to be stopped, causing serious financial consequences in the performance of it.

The Company (CCU) said in a statement its plant located in Quilicura, Santiago, has a 'low production' in the three months following the earthquake, because several teams were damaged.

The earthquake caused breaks in the filtration area and packaged Quilicura factory, located on the outskirts of the Chilean capital and supplies 70 percent of the local market, which implies a loss of about 20 million liters of beer.

The CCU covers 86 percent of the local beer market and sells about 520 million liters a year through its brands Cristal, Escudo, Royal, Heineken and Paulaner, among others.

To avoid large losses, the company reassigned the plant production less affected by the strong

earthquake in the northern and southern Antofagasta Temuco, as well as import beer from its factories in the Argentine cities of Salta, Santa Fe and Luján.

The Brewery Chile, the other major producer of the drink in this country, said on his part to keep your operations 'as biased' in the country due to the damage that the earthquake caused to infrastructure.

In general, companies maintain a safety stock for a minimum of 30 days, although in the case of supermarkets that stock varies between 10 and 30 days, depending on the products, "and even the same room sales also has a safety stock for five to eight days for the immediate replacement, "explains Paul Barberis, Academic Director of Strategic Logistics Diploma from the School of Business at the University of Chile.

However, experts delimit the vast majority of companies have used this system for years without regard to the occurrence of natural disasters and, therefore, are poorly prepared to deal with them when they happen.

"The supply chain has worked because events like these, even when high-impact, occur much lag. The last earthquake as disastrous as it was 25 years ago," says Alex Cantzler, second vice president of the Logistics Association of Chile (ALOG).

Therefore, the solution to the lack of coordination and failure of the supply chain do not seem to define a new system design, but rather that it provides for supply networks less vulnerable, through the implementation of contingency plans disaster.

"Here it is not a company, for your safety, should have more wineries and food stored in the next 20 years, hoping a new event of this kind. This will only create more costs. Here it is that all actors chain have better plans for immediate reaction to these contingencies, "said Cantzler.

In that sense, for Professor Sergio Maturana, head of the Department of Industrial and Systems Engineering at UC, the design of alternative channels of communication, supply and distribution are the innovations that should be part of "Plan B" companies to implement to react quickly and put up the production machine.

"Even some companies would do well to keep a little inventory is a critical ingredient for their production, to meet contingencies like this," says Maturana.

These measures are justified to understand that the stock system failed largely because serious problems in communication that prevented enable replenishment systems, input suppliers who failed or flaws in the transfer of goods by road damage.

As background we comment that normally in the design of the structures that will have beer operations as those plants are in CCU, we review the structures with the actions of both service and accidental, but teams are only reviewed for their operating loads, there is a joint review of the actions of an earthquake with the operation and the connection of its components, including the effect of increased stiffness of the equipment (tanks, piping, conveyors, etc.).

So to present a study of seismic isolation, is normally present the case of a team that requires their continued operation and usually contain liquids, and reviewed the stiffness of the connections, so check the connection to computers the structure is disconnected to prevent the participation of local rigidity in the overall structure, the review is also local connections, supports, and points of stress transmission. At this stage usually develops the business case for measuring the profitability of structural adequacy.

To account for the initial states (baseline), i.e. without insulation project status and financial results to the project, and comparing the financial benefits are taken into account only the results in terms of

costs related to interruption of production, loss of production process, logistics costs and repair costs of damaged areas.

### 2.3. Business and Market Impact

As a fundamental part of the brewing process, it requires large fermentation tanks where the beer in its resting stage, instead of 18 to 20 days, depending on the characteristics of the beer to be produced, then transported by pipeline to filtration tanks.

This step is what allows us to find beer alcohol content and then be passed through the fermentation process which also takes place in large stainless steel tanks, where it stabilized for subsequent packaging and transport to the market for consumption.

Because of this process, which allows different flavor, you really need 15 to 28 days to put a beer from the start of manufacture to be carried to the warehouses of distribution, so that a seismic event that requires unemployment and after starting the production process has to take into account the one hand, the loss of the initial production, being a perishable product, and then to restarting production, manufacturing 20 days to bring the product to their stage packaging and distribution, so that in general an effective stoppage of two weeks leading to the brewery to a stoppage in production for about five weeks distribution in actual production for consumption.

At this stage we review primarily the support of the teams in the foundation and its connections to the structure, determining neoprene type base isolators which have cost around $ 5.000 USD per piece, which according to the costs approximate repair taken information over direct cost of reparation. Indirect costs not normally taken into account, such as loss of market distribution logistics costs, exchange rates, impact on the cost of inputs, could really validate that the business case, being higher the cost of risk, and even multiplied by the probability of occurrence, runs the business case, as compared with the initial investment to use insulators and reduce the risk of injury, even without taking into account the collapse.

### 2.4. Lessons Learned

In the above, have preventive project costs or increased costs of the design of the structure in case you want to prevent (Design for Performance) of the structure, the cost would be bringing in two million four hundred thousand dollars for which, the project Financial Planner compared with the scenario of not taking the prevention of the project and if the filing of the earthquake, taking the cost of repair.

The stage of the repair project, Design by Performance would be taken normal structural elements; part of the earthquake is taken with dissipation by inelastic behavior of the structure. Having the stage without prevention project would have the following costs if the submission of the earthquake.

According to the Business Case normally used in the Corporate Finance compares the initial cost and its subsequent depreciation in the following years, to compare with that of the repair project (what it would cost to repair, a structure already depreciated, i.e. already generated its depreciation to the company, so the maintenance cost is increased).

## 3. PREVENTIVE MEASURES AND FINANCIAL ANALYSIS

As we can see, in the case of businesses that normally occurs to justify a preventive type of sink do not take into account the costs incurred by the interruption of business, which greatly increases the cost of repairing the structure, because we have to add logistics costs of bringing products elsewhere, but also in the case of many companies, inventory is lost, causing customers to no longer seek the product, but to change their preferences to other goods of competition, giving rise to loss of market, besides the inputs to volatilize the economy becomes more expensive (especially those who are in foreign currencies, caused by the drop in local currency by reducing the impact of economic activities). For all

these reasons, returning after the earthquake with minor damage to the operation and the market (in the case of the brewer CCU, was three months plus one month for repairs to return to produce inventories of beer, made a total time of 4 months).

All this completely reverses the business case, because the time an earthquake occurs with minimal damage, but cause business interruption for repair of non-structural and structural repairs minimal, damages the market and has a direct impact on financial statements of the company, thus affecting the profitability (business interruption), and the market (market losses due to changes in consumer preferences).

### 3.1. Seismic Devices

Presenting the business case that shows the costs by statistical chance occurrence of a quake in the year 07 of the project, it is clear that the impact of stopping operations has reversed dramatically impact the project cost being more than 10 years the impact suffered by the costs of the earthquake.
For CCU, we can measure the impact of business interruption was 30% of the beer market that they had before the earthquake (you can see from the graph of the beer market) and its projection to the next 6 years (although is plotted only until 2015).


**Figure 4.-** Projection of Beer Market behavior

### 3.2. Cost Analysis: Direct and Indirect

We can see from the graph of impact, the fall of the Chilean market for beer, the acceleration caused by the lack of beer in the period were focused on rebuilding suffered slight damage. We can also see that the effects of increases in other products that took the market share that could be satisfied by the brewer CCU.

### 3.3. Prevention projects without seismic prevention projects

The following analysis is sustained impact on the structures of the brewers, as can be seen which were minor impacts but that required discontinuation of operations for reconstruction.

When damage is in Bodegas, these immobilized production areas as there is nowhere to send the finished product. The supply chain is disrupted.

The starting area of production (tanks) is damaged and stops it because it needs to repair the

foundation of the same and prevent accumulation of dirt in the zones created by the inelastic deformation of materials.

We also have flaws in the foundations of the tanks, leading teams to move from their original places, breaking the continuity of the pipes and thus preventing the manufacturing process can be carried out.

The damage in the areas of packaging affects the inventory process since not only the production lost was in the process of packaging, but unable to package the product in tanks, inventory that is lost is larger.

**Figure 5.-** Damage photos Brewery**.**

Failures in these areas are normally valued as loss because inventories at this stage and are valued in background areas of the process is more difficult to value the losses because the product is not finished.

**Figure 6.-** Damaged Packaging and Storage

## 4. CONCLUSIONS

As can be seen in the development of the proposal, the feasibility analysis of construction projects and projects proposed installation of seismic dissipation should not be considered in business cases comparing the recovery investment alone against the costs of repairing damage to a seismic event, plus inventory and damage to company assets, but also must take into account the indirect costs of not having at that time the product in a market as competitive as today's, where if we cannot offer the consumer the product changed to another, and to get used to another product, where it can offer the product again after repairs, it will not be sought by the consumer, this is called loss of market, and its valuation is much stronger than the material losses usually quantified.

Business interruption must be a point to examine the feasibility studies of the structures that will contain products processing equipment.

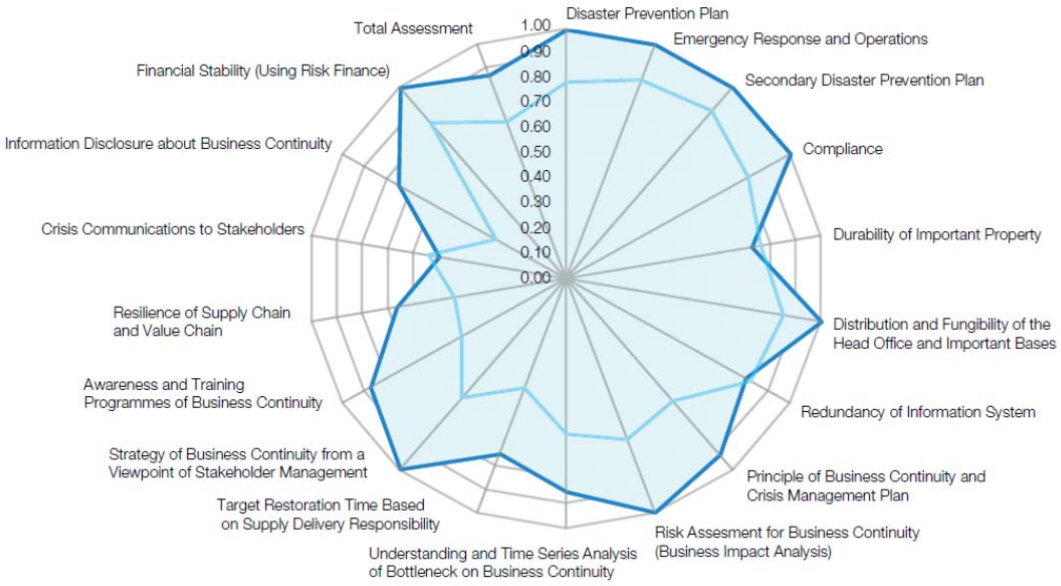


**Figure 7.-** Earthquake Impact in 18 metrics (Proposed by Bank of Japan in 2011)**.**

In this study displayed a second phase which consists of verifying the economic impacts of the financial impact caused by the earthquake, such as building materials that become more expensive after the earthquake (supply and demand) and causes the repair studies are undervalued in the business cases presented under normal costs.

For case studies of financial recovery is necessary to develop tools that consider the likelihood of an earthquake, with elements of justification of the investment more in line with modern times, as the technology develops, and the complexity and interrelatedness of the investments, the economic impact of disasters is higher, leading to reconstruction costs have become increasingly important.

The tools do not provide current financial scenarios as complicated as the return periods of major earthquakes in areas near fault lines, which should give more accurate elements in calculating the financial impact of an earthquake, not to mention the social and human cost thereof, but largely underpinned by the economic benefit of the prevention elements.

Also the recent earthquake in Japan (The 2011 earthquake off the Pacific coast of Tohoku) found the global impact on manufacturing as it existed parts and components of various kinds that were only made in the area of Fukushima. Japan, which led to a Business Interruption Impact unprecedented.

The ultimate impact in CCU and two years of the quake was largely absorbed by the operations of the same company on the factory of other countries, or even with other brands (this is called dilution of risk in the portfolio of the company) but the cost in insurance, had an impact on the financial statements of the company and the change in consumer taste led them to have to redirect marketing strategies to regain market (primarily Crystal Beer, which is the local brand).


**Figure 8.-** Brewery Process**.**

Is necessary to study the side of insurers a method to prevent and better manage risk and thereby reducing the, already, high costs of insurers and Reinsurance Company worldwide.

Finally, the current trend in the structural design, leads to not only take into account the preservation of human life at all costs, but sometimes also the assets (equipment and facilities) to allow continued adequate standard of living after a natural disaster because even losing these assets, leading to endanger human life and the subsequent reconstruction a strong earthquake, not only in the local point of disaster, but their influence in the world for its current interconnection.

**REFERENCES**

Bevere, Lucia and Villat, Jessica (2011). Lessons from recent major eathquakes. Economic Research & Consulting, *from Swiss Reinsurance Company Ltd,* **January 2012**, 1-15.

Global Risk 2012, Seven Edition (2012). Committed to Improving the State of the World: an Initiative Risk Response Network. *from World Economic Forum,* **Insight Report Seven Edition 2012**, 28-35.

Rogers, Brian, and Grollimund, Balz (2011). Natural Catastrophes and man-made Disaster in 2010: a year of devastating and costly events. *SIGMA from Swiss Reinsurance Company Ltd.,* **No 1 / 2011**, 6-32.