

SWOT ANALYSIS IN MANAGEMENT AND DANGER OF SNOW AVALANCHES IN SPAIN

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ABSTRACT: The impacts of avalanches in Spain, including deaths, are concentrated in recreational and mountain sports activities, as well as in mountain and ski areas, roads and infrastructures. For the management of the danger of avalanches, defence structures, zoning, forecasting and control are included. The problems with the development of new technologies and specialized services in the management and mitigation of the danger are identified. Throughout this work we analyse the strengths and opportunities along with the weaknesses and threats of scientific and technical knowledge and the management of risk and the mitigation of accidents by avalanches. Spain has several mountain areas apart from the Pyrenees that are vulnerable to this natural risk but the culture of snow and avalanches are still limited or non-existent in many areas. Up to now, important changes have been made in the last few years in the management of the danger by avalanches, but many improvements are still possible, justified by the increase of winter activities in the mountain, as well as by the increase in the number of practitioners. Progress in the solution of these problems is identified with an emphasis on the inhabited areas, areas of ski resorts and annexed areas and in natural environments where winter mountain activities have grown exponentially in the last decade. Reviewing the past and the current situation it is necessary to take into account various objectives and fulfil them in the future.

KEYWORDS: accident, rescue, education, Pyrenees, risk management, Spain

1. INTRODUCTION

SWOT analysis (or SWOT matrix) is a strategic planning technique used to help a person or organization identify the *Strengths*, *Weaknesses*, *Opportunities*, and *Threats* related to business competition or project planning. It is intended to specify the objectives of the business venture or project and identify the internal and external factors that are favourable and unfavourable to achieving those objectives. Users of a SWOT analysis often ask and answer questions to generate meaningful information for each category to make the tool useful and identify their competitive advantage.

A SWOT analysis can be used to explore new solutions to problems, to identify the barriers that will limit objectives to decide on the most effective direction to reveal the

possibilities and limitations to change something.

This article presents a SWOT analysis adapted to the management and danger of snow avalanches in Spain.

1.1 SWOT analysis factors

Strengths and Weakness are frequently internally-related, while Opportunities and Threats commonly focus on environmental placement.

- **Strengths:** characteristics of the business or project that give it an advantage over others.
- **Weaknesses:** characteristics of the business that place the business or project at a disadvantage relative to others.
- **Opportunities:** elements in the environment that the business or project could exploit to its advantage.
- **Threats:** elements in the environment that could cause trouble for the business or project.

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The degree to which the internal environment of the firm matches with the external environment is expressed by the concept of strategic fit. Identification of SWOTs is important because they can inform later steps in planning to achieve the objective. First, decision-makers should consider whether the objective obtained by SWOT is attainable or not. If the objective is *not* attainable, they must select a different objective and repeat the process.

1.2 Study area: Spain.

The relief of Spain is characterized by being quite high, with an average altitude of 660 meters, quite mountainous if we compare it with the rest of European countries and only surpassed by Switzerland, Austria, and the microstates of Andorra and Liechtenstein. In the peninsular Spain, the relief is articulated around a great Central Plateau that occupies most of the centre of the Iberian Peninsula and that has an average altitude of 660 meters. Outside the Plateau, there is the depression of the Guadalquivir River, located in the southwest of the peninsula, and that of the Ebro River, in the northeast of it.

The mountainous systems of Spain are very numerous and occupy almost half of the national territory. The Pyrenees (in the northeast limit) and the Béticos systems (in the southeast) are the highest mountain ranges and are located outside the Central Plateau. Surrounding this one is the Cantabrian mountain range in the north, the Iberian system in the east, and Sierra Morena in the south. Within the Central Plateau are the Central system and the Montes de Toledo (Figure 1).

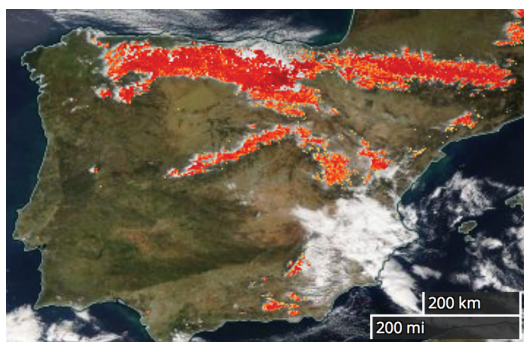


Figure 1: Snow cover in the Iberian Peninsula the 9th of February, 2015, after an important snowfall in which the main mountain ranges of Spain are identified. The MODIS Normalized Difference Snow Index (NDSI) snow cover layer shows the presence of snow cover (in red colour) over

land and water bodies as an index related to the presence of snow./ © NASA.

2. KNOWLEDGE AND STRENGTHS

2.1 Scientific-technical knowledge

State Meteorological Agency - AEMET has the competence in the assessment of danger, the risk of avalanches and their prevention in Spain, except in Catalonia. [Pyrenees: Navarra / Aragón / Catalonia] - Picos de Europa National Park (Asturias-Cantabria-León) - Alto Campoo (Cantabria) - Sierra de Guadarrama National Park (Madrid-Segovia)].

The Cartographic and Geological Institute of Catalonia - ICGC has the competence in the assessment of danger, the risk of avalanches and their prevention in Catalonia.

The General Council of Aran - CGA (Center Lauegi) and A Lurte evaluate the danger and risk of avalanches and are responsible for their prevention in their areas of influence: Aran Valley and Aragón's River Valley.

The ICGC and the CGA would systematically invent and document the avalanches.

Organizations and institutions of the Government of Catalonia and the Ministry of Agriculture, Food and Environment write technical studies and projects related to avalanches.

In Catalonia there is a map of Avalanche Zones (MZA) at a scale of 1: 25,000 (14 pages).

The Avalanche Database of Catalonia (BDAC), public and searchable on the ICGC website.

The frequency / detail of issuance of Avalanche Reports is adjusted to the demand in Catalonia.

Good scientific and technical knowledge in the different prediction services.

There are official technical guides that assure and standardize the quality of the nivometeorological observation work published by AEMET and the ICGC.

2.2 Risk management and mitigation

The Cortes Generales approved in 2007 the Law of Land (today recast in the text approved by Legislative Royal Decree

2/2008, of June 20), where it is established that urban developments must undergo a previous environmental evaluation a sustainability report, which must include a map of natural risks and the management of it.

The Basic Civil Protection Standard, Special Plans or specific risks, Autonomous Plans and Local Plans are an opportunity to include avalanche emergencies.

The urban planning law considers the avalanches in the Urban Management Plan - POUM.

There is artificial triggering of avalanches - PIDA in some ski resorts.

There are local predictions on several communication routes: Belagua Pass (NA-137 Burgui-Isaba-France); Somport Pass (N-330 and N-330a), general road of Tena Valley (A-136); Access road to the Panticosa Balneary (A-2606), Tunnel of Bielsa (A-138), access road to Llanos del Hospital (A-139); Bonaigua Pass (C-28), access road to Beret (C-142b). Some other local prediction is made in the Eastern Pyrenees of Catalonia, Vallter 2000 and the Collada de Toses, as well as in Cantabria.

Different organisms and national, autonomous or local institutions install anti-avalanche defence structures.

The forest law considers the qualification of protection forests to reduce the risk of avalanches.

There is a mutual aid agreement with France that should be updated. It is possible the existence of more agreements between different international agents that affect Spain.

The subject of the risk of avalanches begins to be contemplated in the educational system, mainly in mountain areas vulnerable to the phenomenon.

Consolidation of the Association for the Knowledge of Snow and Avalanches (ACNA), is an entity that promotes knowledge of avalanche risk.

3. WEAKNESSES AND THREATS

3.1 *Scientific-technical knowledge*

An official, public and homogeneous State Avalanche Registry is missing.

It is necessary to quantify the economic, socio-cultural damages and losses, etc.

There are no official technical guides to ensure and standardize the quality of the work. Only the area of the Nivometeorological Observation has been worked on.

With the exception of Catalonia, in the rest of the communities there is no avalanche zone map (MZA) at a scale of 1: 25,000 for public access, and the cartographies that exist are small scale, lacking in detail and useless for most jobs.

There is a lack of cartography on the danger, vulnerability and risk at scales of detail that prioritize urbanised areas.

There is a lack of in-depth studies on the influence of climate change on the severity and frequency of avalanches.

Missing studies of accidental avalanches that affect buildings and infrastructures where economic damage has been significant or there are fatalities.

3.2 *Risk management and mitigation*

There is no basic planning guide for Civil Protection due to avalanches.

Most national, regional or local plans of affected areas do not consider avalanches.

In many cases, the Land Law is not complied with, there are no cartographies and irregularities in Territorial Planning regarding natural risks are accepted and contemplated.

An inventory of avalanche critical points is missing to be considered in the POUMs.

Regulatory zoning of danger is missing.

The lack of regulation makes to enforce and regulate the implementation of the PIDA in all ski resorts.

Many ski resorts lack of PIDA and do not trigger artificial avalanches.

There is a lack of standardisation of the Avalanche Hazard Reports.

There is a lack of systematic validation of the results of the avalanche reports.

There are many critical points on roads and isolated buildings that do not have a prediction.

They are requesting and in some cases granting licenses to build or expand buildings and infrastructures in areas where previously significant avalanches have

been registered: Canfranc-Estación, Refugio de Espigüete ...

A coordinated action plan is missing.

There is lack of definition of residual risk.

In many cases, the defence infrastructures are installed without revision and maintenance, and are inefficient.

They continue to build exorbitant public budgets with undersized defence structures that do not mitigate the problem: anti-avalanche barriers in the Bonaigua Pass (C-28), avalanche gallery of Senarta 1, etc.

There is no systematic management of protection forests.

There is lack of knowledge implementation in the near geographical environment and a reflection on self-protection.

4. CONCLUSIONS

The increase in winter activities in the mountains, as well as the increase in the number of practitioners, has evidenced the need to report on snow and avalanche conditions.

Knowing this danger and persisting in the study of avalanches and the areas most vulnerable to this risk is a pending work in which the administration must take part in the near future.

Administrations should not wait for a catastrophic event / accident to apply preventive policies.

Growth and urban pressure must never become an obstacle to applying scientific knowledge, elaborate detailed cartographies regulate and apply existing regulations.

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