The Socioeconomic Impact of the Swiss Federal Institute for Snow and Avalanche Research

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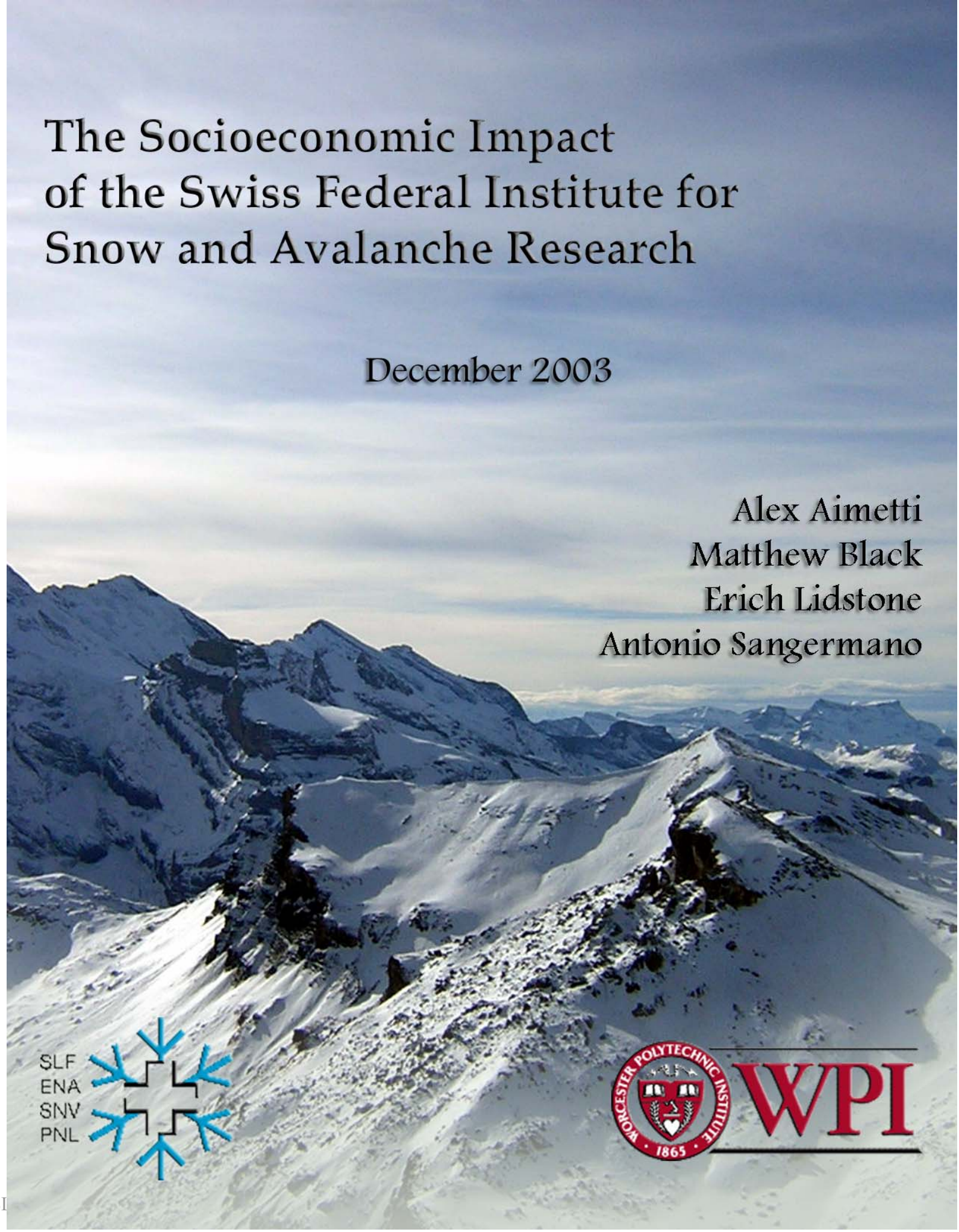

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Abstract

Research centers across the world spur scientific discovery and technological innovation. However, research institutes require financial support to conduct and expand their research. As an internationally recognized institution, the SLF has profound effects on the local economy, provides a range of educational benefits, and positively affects the people of Davos and Graubünden. We assessed its contributions in these areas by examining SLF records, surveys of Institute employees and conference participants, the SLF's educational programs, and the Avalanche Bulletin, and trends in avalanche damages.

Acknowledgements

We would like to thank the Swiss Federal Institute for Snow and Avalanche Research (SLF) for sponsoring this project. We would also like to thank all of the employees at the SLF for taking the time to complete our survey and providing us with all of the necessary data.

Executive Summary

Research centers across the world spur scientific discovery and technological innovation. Research is the first step toward making advances in any field. However, scientific discoveries come at a price. Research institutes require financial support to conduct and expand their research. One way to justify an organization's merit for financial support is to quantify the impact it has on its host community. While the primary purpose of research institutes is to make scientific advancements, these centers also provide benefits to the surrounding communities that are not as obvious.

One such institute is the Davos-based Swiss Federal Institute for Snow and Avalanche Research (SLF). Dedicated to the study of snow and the prevention of dangerous avalanches, the SLF also provides many benefits to Davos, Graubünden Canton, and Switzerland. The purpose of this report is to quantify the SLF's impact on the region to prove that the region benefits because the SLF is located in Davos.

There are many different ways in which a world-renowned organization can benefit a host community. As a distinguished institution, the SLF affects the local economy, provides a range of educational benefits, and affects the people of Davos and Graubünden.

The SLF is a World-Renowned Research Institute

The SLF is an internationally recognized research center, specializing in snow, avalanche, and alpine environment research. It is recognized by its peers as a leader in its field, by the community as an expert source or information, and by the general public through its frequent media appearances.

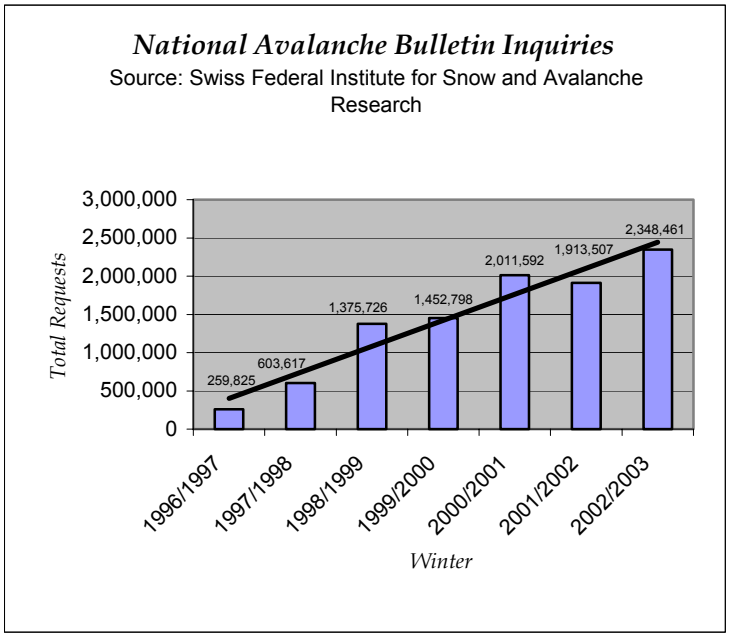


Figure i: National Avalanche Bulletin Inquiries

The SLF is held by its colleagues around the world to be the top in the field of avalanche research. The SLF was "recognized internationally because of its leadership in the area" in 2001 in a study conducted by institutions around the world. The study further concluded that the SLF performed well in subjects such as education, research, and publications. In fact, over the past five years, the Institute has published an average of 52 journal articles per year, accounting for 20% of the WSL's, which is the parent organization of the SLF, total publications. Government agencies, such as the Swiss National Science Foundation and the Swiss National Office of Education and Science also respect the SLF's work, as they awarded it with over CHF 2 million in grants in 2002

The SLF is respected in the community as an expert source of information with regard to snow and avalanches, primarily because of the Avalanche Bulletin, which is

one of the most prevalent ways that the SLF disseminates information about avalanche dangers. In the 2002 and 2003 winter, the bulletin was accessed approximately 2.3 million times. This number has increased over 800% since 1996, when documentation of the inquiries began (see Figure i).

In addition, many newspapers and magazines reference the SLF as the primary source of information with respect to avalanche risk areas. In 2002, the SLF was mentioned in 309 articles resulting in over 6.5 million published copies. The distribution increased in 2003 to a total of 283 articles summing over 16.1 million published copies. If the space that the SLF occupied in print media was used for advertising, it would cost over CHF 11 million annually. The exposure the Institute gets from its media appearances brings the SLF name to the public.

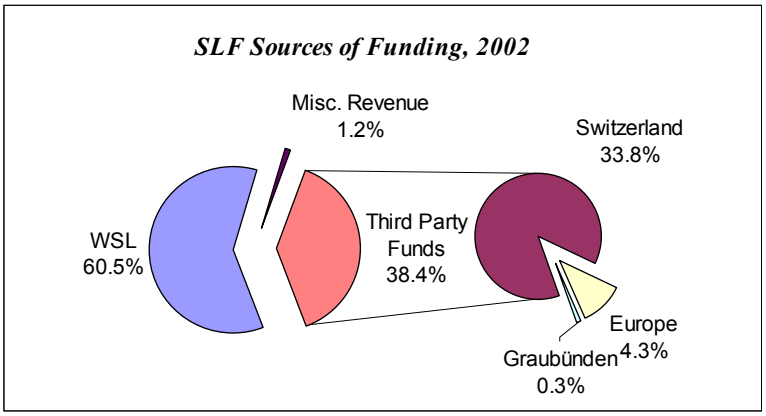


Figure ii: SLF Sources of Funding in 2002

Two additional media, radio and television, enables the Institute to reach a wider population. The SLF personnel appear on DRS-1 daily to discuss avalanche hazards throughout Switzerland. The Institute conducts similar interviews on a biweekly basis on DRS-3. The SLF is mentioned regularly on 18 television stations, both inside and outside of Switzerland. As the SLF is recognized throughout and beyond Switzerland as a world leader in snow and avalanche research, it provides several other benefits to the community of Davos and Graubünden.

The SLF Affects the Economy of Davos and Graubünden

Our data suggest the SLF's impact on the local economy is considerable. Nearly all of the SLF's funding comes from outside of Canton Graubünden. This external funding is then distributed to the local economy in three main ways – through the SLF's employees, institutional expenditures, and conference guests.

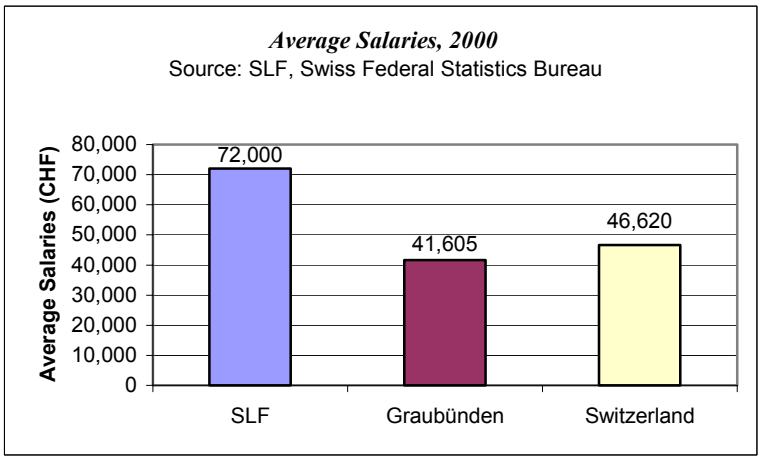


Figure iii. Average Salaries at the SLF compared to Regional Averages

The WSL, which provides funds from the federal government, contributed 60 percent of the SLF's CHF 14.7 million in funding during 2002 (see Figure ii). The remainder came from third parties, which consists of different governmental and private organizations. Funding from Graubünden Canton constitutes only 0.3% of the SLF's total funding.

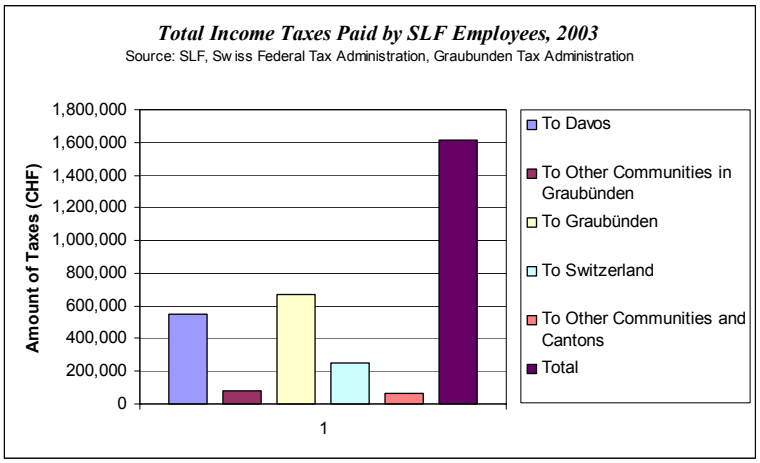


Figure iv: Total Income Taxes Paid by SLF Employees, 2003

For every Swiss Franc the SLF receives from Graubünden Canton, it spends CHF 101 in Davos. It is also interesting to note that third party funding has increased steadily over the past 10 years. This funding has a direct effect on the number of people employed by the SLF. The SLF's employees have a positive effect on the local economy and on government finances. SLF employees have an average income that is considerably higher than that of Graubünden and of Switzerland (see Figure iii). In 2003, 82 percent of the SLF's CHF 10.4 million in wages will go to employees who reside in Davos. The SLF employees will spend an additional 3.85 million Swiss Francs in Davos and pay 1.61 million Swiss Francs in income taxes (see Figure iv).

The Institute's expenditures and guests also affect the local economy. The direct effects of the SLF's and guest's spending sum to over CHF 1 million. Indirectly, this generates an additional CHF 700 thousand in economic activity.

In total for 2003, the direct effects sum to CHF 15.3 million. Approximately 63 percent, or CHF 9.61, was spent in Davos. The total impact on Davos due to the SLF was CHF 14.75 million (see Figure v). Through the Institute's employees, expenditures, and guests, the SLF benefits the local economy by bringing a substantial amount of money from outside the region into Davos

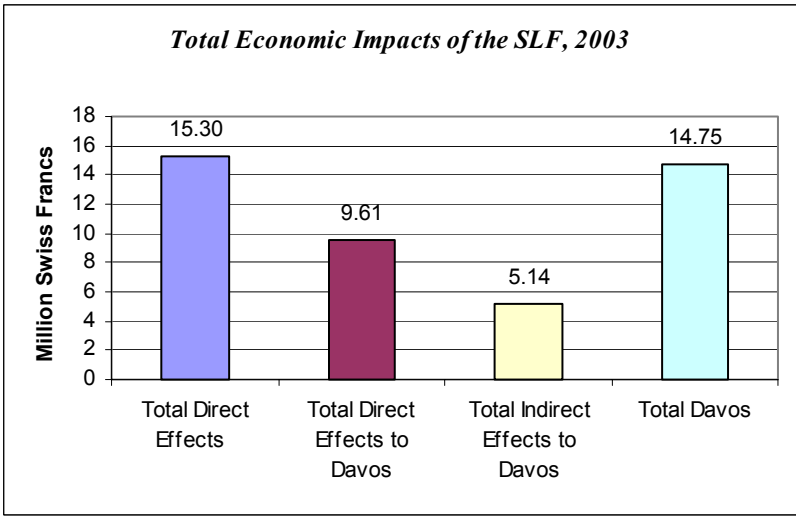


Figure v: Total Economic Impacts of the SLF, 2003

The SLF Provides a Range of Educational Benefits

The SLF acts as an institution of higher education because it supports the educational efforts of students seeking diploma and doctorates, as well as offering many programs for the general public. The report examines the effects this has on a wide range of people, from doctoral students to community members.

The SLF provides students with in-depth experience in snow and avalanche research. There are currently 33 students, who are enrolled at one of the cantonal universities, doing research with the SLF. Since Graubünden does not possess a university, it paid CHF 20.9 million for university students and CHF 8.09 million for graduate students to attend universities in other Cantons. It receives no reimbursement for higher education services of any kind, including for the education provided by the SLF. However, the tuition for the 33 students at the SLF amounts to nearly CHF 500,000.

The SLF offers a variety of educational programs that contribute to educating the community. One program that serves to educate people about research at the SLF is the Public Guidance program. At the time of our study, the total attendance of these tours for 2003 was over 2500 (see Figure vi).

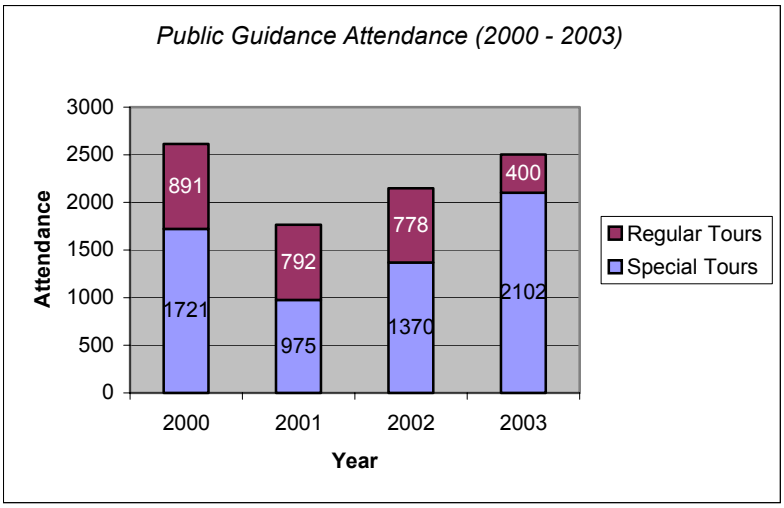


Figure vi: Public Guidance Attendance (2000-2003)

For the past two years, two of the most popular programs hosted by the SLF were the Winter and Mountain Experience Paths. Approximately 35,000 people attended the two paths each year.

The Institute also holds a variety of conferences and summits in its field. In 2003, the SLF held 13 conferences with a total attendance of 922 people. Conference participants agree that workshops are educational and engaging, and that they would recommend another SLF-hosted conference to their colleagues.

The SLF provides a range of educational services to Davos and to Graubünden. The wide range of research conducted at the SLF provides a valuable base for doctoral students to come to Davos to conduct research in their specialized fields. It also offers a variety of programs to educate those interested in snow and avalanche research. The programs that the SLF holds for the public and for its students are a significant contribution to the public, both locally and nationally.

The SLF Affects the People of Davos and Graubünden

The SLF's research and services show the range of effects brought to Davos, Graubünden, and Swiss residents. While we cannot conclude that the SLF saves

lives directly, its avalanche warning service does contribute to preventing avalanche accidents and damages.

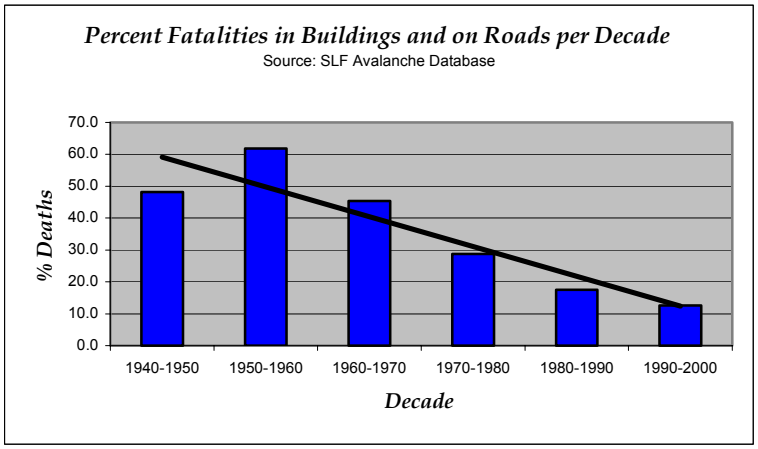


Figure vii: Percent Fatalities in Buildings and on Roads per Decade

To extend their knowledge to the public, the SLF provides the widest avalanche warning service in the world through the Avalanche Bulletin. The bulletin was accessed over 2.3 million times in the winter of 2002 and 2003 and has experienced over an 800% increase since the winter of 1996.

The warning service has proven successful since it was started in the early 1940's. By taking the service's warnings into consideration, people can take proper precautions, such as evacuating homes or closing roads, in a potentially dangerous avalanche situation. It is agreed that fatality in a home or on a road today would be a severe disaster. The bulletin has contributed to a decline in the percent of fatalities on roads and buildings over the past 6 decades (see Figure vii). In 2000, deaths in buildings and on roads accounted for only 5% of the total Swiss avalanche fatalities.

Avalanches are destructive natural disasters that can cause extensive damage to both people and economies. Not try to warn people of potentially dangerous avalanches, it also seeks to prevent them from occurring. Preventative measures are linked to a decreasing trend in Swiss avalanche damages between 1977 and 1998 (see Figure v iii).

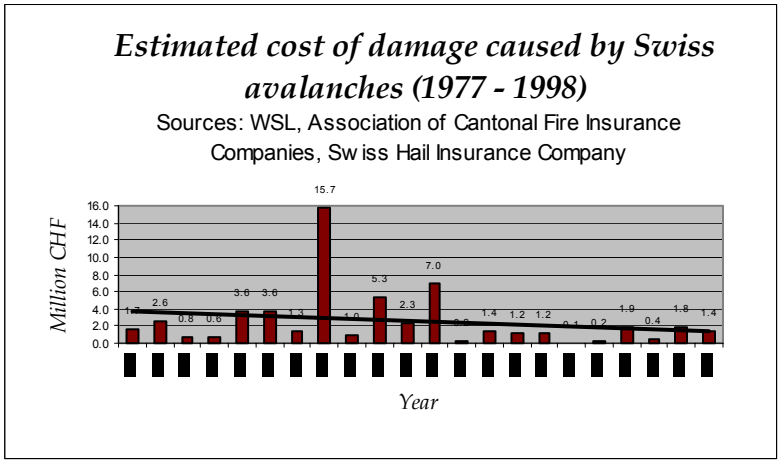


Figure viii: Estimated cost of damage caused by Swiss avalanches (1977 - 1998)

The SLF's goals include preventing and warning people of dangerous avalanches. An increase in the use of the avalanche warning service and decreasing trends of deaths in populated areas and damages lead one to infer that the SLF has been successful in these areas.

Conclusions

From out data we conclude that the SLF provides a wide range of important benefits to Davos, Graubünden Canton, and Switzerland. Through its research and

technological expertise it brings recognition to the local area. In addition, the Institute has a substantial effect on the economy of Davos and the Canton, as it provides an employment base and an average salary that is higher than the Swiss national average. Thirdly, the SLF provides a range of educational benefits to the locally and nationally. It has helped to reduce avalanche risk in populated areas substantially, despite increases in population and tourism. As the world-leader in its field, the SLF provides numerous contributions on local, national, and international levels.

1. Introduction

Research centers across the world spur scientific discovery and technological innovation. Research is the first step toward making advances in any field. It is necessary to experiment and seek new knowledge to further science. However, scientific discoveries come at a price. Research institutes require financial support to conduct and expand their research. Acquiring different sources of funding and additional finances is an important concern among research institutes. One way to justify an organization's merit for financial support is to quantify the impact it has on its host community. While the primary purpose of research institutes is to make scientific advancements, these centers also provide benefits to the surrounding communities that are not as obvious.

One such institution is the Davos-based Swiss Federal Institute for Snow and Avalanche Research (SLF). Dedicated to the study of snow and the prevention of dangerous avalanches, the SLF also provides many benefits to Davos, Graubünden Canton, and Switzerland. Institute researchers analyze the characteristics of snow and avalanche formation to advance the state of the art in avalanche warning and prevention technology. In addition to performing research, the SLF issues the national avalanche bulletin to warn Switzerland about current avalanche dangers. However, like any other research institution, additional funding is crucial. The purpose of this report is to quantify the SLF's impact on the region to prove that the region benefits because the SLF is located in Davos.

There are many different ways in which a world-renowned organization can benefit a host community. Major research centers bring a substantial amount of attention to their respective communities. They increase and stimulate interest in research, even in areas beyond their immediate field of research. Many areas, such as Silicone Valley in California or the Route 128 beltway in Massachusetts, advertise themselves as areas that concentrate in research and use this fact to draw visitors to the area.

Renowned institutions provide economic, educational, and social benefits to society through the course of their work. Perhaps the most easily quantifiable benefit of research institutions is the economic impact they can have on their host communities. Research centers directly provide employment at many levels, from custodians to highly educated research scientists. Their purchases on everything from food to high-tech research equipment bring money to the local economy. Conferences held at research

centers bring visitors, and therefore money, into the region as these guests spend money on hotels and restaurants. Through these methods research centers bolster their local economy.

Many research institutes also provide numerous educational benefits, which closely relate to the primary research mission. This education may be imparted through many means, including classes, seminars, and partnerships with other local institutions or schools. The community learns about the activities of the research center and topics related to their research. Excellence in education can also bring positive attention to the community.

Research institutes often serve the local area by providing expertise to solve problems of concern to community members. The social impact is characterized by how well the organization benefits the community and how well society accepts the organization and the services it provides. Communities throughout the world reap economic, recognition, educational, and social benefits from nearby research institutions.

The SLF's advanced research in avalanche prevention and its distinguished reputation in its field brings attention and contributes to the identity of Davos and Graubünden Canton. The SLF affects the local economy, which can be described concretely in terms of Swiss Francs and jobs. It provides educational services in the forms of courses, conferences, and doctoral work. The avalanche preventative measures, such as the posted avalanche bulletin, have a social impact in preventing fatalities and damage that could be caused by avalanches. Combining these individual effects results in the total impact of the SLF. No comprehensive assessment of the SLF's impact has ever been done in the past. The purpose of this report is to quantify the SLF's impact on the region to prove that the region benefits because the SLF is located in Davos.

Through the course of this analysis, we describe and quantify both the concrete and less tangible benefits that the SLF brings to Davos, Graubünden Canton, and Switzerland. Our evaluation of the SLF's services provides them with the ability to better control the focus of their resources in snow and avalanche technology and, in doing so, act as a more effective organization for Switzerland.

2. Literature Review

To assess the benefits the SLF brings to its community, it is necessary to understand how others have examined similar institutes and in what ways general benefits can be described. In this background chapter, we first describe how institutions are recognized and respected for their work. We then identify three further categories for characterizing the benefits of the SLF: economic, educational, and social benefits. We describe why each area is important to the SLF and analyze case studies to show how organizations have examined these benefits in the past to justify their research. This study is similar to these case studies and builds from the foundation they provide while taking into consideration the unique circumstances of the SLF and Switzerland.

2.1 Recognition

Research institutions around the world have a profound effect on their surrounding communities. World-renowned research centers such as MIT and CERN bring great amounts of prestige to their respective communities. One of the influences the SLF has on Davos and Graubünden is the name recognition it brings to the region. As part of the total impact on the region, the prestige associated with an institution such as the SLF should be taken into consideration when examining its impact.

2.1.1 Impact of Research

One technique used by the Colleges of the Worcester Consortium was to present the impact of the faculty and of the research they conduct. In the Worcester study, prominent faculty members are recognized with a short summary of their work and recent accomplishments. The impact of the research they conduct was of particular interest in our study, because the goal of the SLF is to provide preventative measures toward avalanches and to research the structure and nature of snow and ice. In the Worcester Consortium study, this nature of impact is addressed in the accomplishments of the faculty.

One such instance is the description of Saul Tzipori, Ph.D., and his work against toxin-producing E. coli. They write that his work may be the first step toward a vaccine, and that it has resulted in a larger study for the design of molecular techniques to manufacture the antibody. This method concisely illustrates the amount of attention

brought to Tufts University, the institution associated with his work. This distinction is, in turn, reflected to the local community (Colleges of the Worcester Consortium, 2001).

In the summary of the work of Osvaldo Golijov, Ph.D., the Worcester Consortium shows that he has won various awards for his work in music composition, and that his pieces are performed at concert halls around the world. This world forum brings attention to his university, the College of the Holy Cross. Descriptions of the work performed at a research institution such as those in the Worcester Consortium study (2001) convey the amount of attention brought to the location due to the research and, in doing so; help to illustrate the prestige brought to the area.

2.1.2 Forms of Recognition

There are several levels on which institutions such as the SLF bring prestige to their host communities. Research centers gain recognition from their peers through the research they perform and through funding from important sources, such as government agencies. The research they perform is published in journals pertaining to their studies.

Institutions are also able to generate recognition in the community as a result of their expertise in the fields of their research. The researchers employed at such an organization serve as a resource for the community in which they reside. They can serve as a particularly valuable source of information if their research directly affects the community as well. The SLF's work in snow and avalanche research has direct applications for the community of Davos and Canton Graubünden.

Another way in which research institutions bring attention to the local area is through the media. When the media consult a research center for information, the institution is considered to be a reliable source of information by the public. The SLF is consulted daily for information regarding avalanche risk, and as such, its recognition as a reliable source of information is widespread.

Recognition is a valuable resource provided to communities that possess research institutions. These institutions produce recognition in several ways, on a variety of levels. Institutions generate such prestige on many levels, including among their peers, in the community, and as a professional organization. This recognition helps the organizations provide other benefits to their local regions as well.

2.2 Economic Impact Analysis

A research institution's economic benefits are the most easily quantifiable of its impacts. Our economic impact analysis measures the benefits that the SLF provides in Swiss Francs and jobs created to Davos and Graubünden. There are several indicators, including sources of funding, jobs produced, local expenditures, spending of guests, employee taxes, and multiplier effects that demonstrate the economic impact. Below, we explain why each indicator is important and how other institutions have examined them.

2.2.1 Sources of Funding

The SLF can be viewed as an "export" industry given that it sells its services to groups outside of the local economy, such as the federal government. As the SLF spends its budget on local payroll and purchases, money is distributed to the community. The more funding generated outside the region, the more it benefits the local economy (Sedway Group, 2003).

The Sedway Group (2003) broke down the sources of revenue for the University of California at Berkeley (UC Berkeley) by location. Obtaining data from the 1998 Annual Financial Report, the UC Office of the President, and the UC Berkeley Budget Office, Sedway group found that 75% of the revenue that the University received was from outside the surrounding Bay Area. Table 2.2.1 shows the breakdown of UC Berkeley Sources of Revenue for 1998-1999. They separated the revenue sources by categories and determined the total and non-local revenue in each category.

Table 2.2.1: UC Berkeley Sources of Revenue, 1998-1999 (Sedway Group, 2003)

Source	Total Revenue	Revenue from Outside Bay Area	Percent from Outside Bay Area
State Government	$465,704,000	$465,704,000	100%
Federal Government (1)	239,251,000	239,251,000	100%
Tuition and Fees	230,234,000	130,500,000 (2)	57%
Private Gifts and Contracts	133,588,000	67,680,000 (3)	51%
Local Sales and Services	138,721,000	0	0%
Total	**$1,207,498,000**	**$903,135,000**	**75%**

Notes:
(1) Does not include all federal research funds that are spent at UC Berkeley because some research programs are not accounted for in the annual financial reports published by the UC Office of the President.
(2) Includes $36.1 million in non-resident tuition and 65.4% (students from outside Bay Area – see Table 15) of regular session fees.
(3) Includes $28.2 million from foreign-based companies, governments, and organizations and $39.5 million in investment income.

The Sedway group also broke down the University's expenditures into total spending and spending within the Bay Area. For every dollar of revenue received from the Bay Area, the University spends 2.77 dollars in the Bay Area. The following sections will describe how this money is spent on wages, goods, services, and construction.

2.2.2 Employment

Another way that money flows into the local economy from the SLF is through Institute employees. The amount and type of jobs created by the SLF serves as a measure of its impact on the local economy. The average salary, range of salaries, and home residence of employees are important factors.

In a study, Appleseed, Inc. (2003) demonstrated the different advantages of employment at eight major research universities in Boston (Boston College, Boston University, Brandeis University, Harvard, Massachusetts Institute of Technology, Northeastern, Tufts, and University of Massachusetts at Boston). For example, using data from university employment records, Appleseed determined that the eight universities employed nearly 50,000 people in the year 2000. Approximately 80 percent of these employees are full time. Figure 2.2.1 shows that the Boston research universities employ numbers comparable to other leading industries.

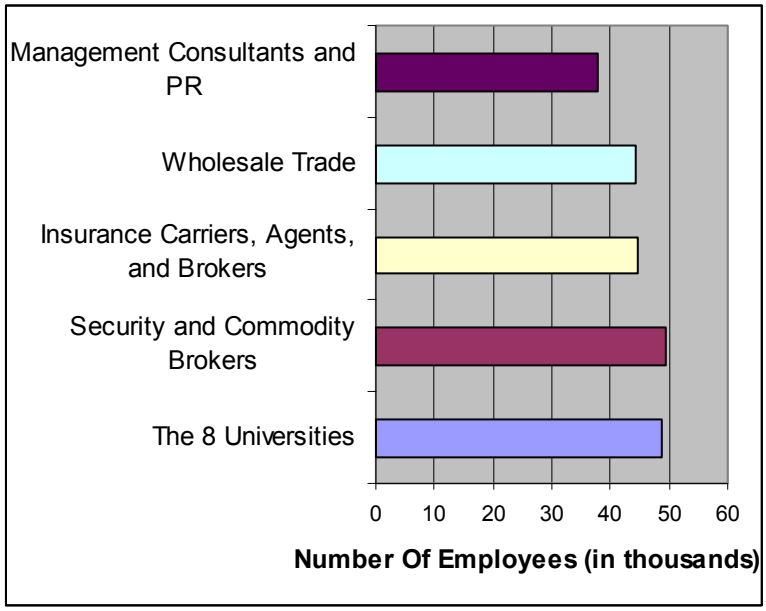


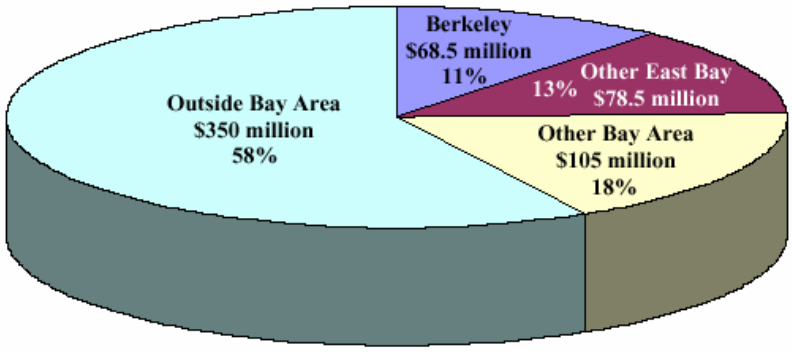
Figure 2.2.1: Employment at the Eight Boston Research Institutes Compared with Leading Industries (Appleseed, 2003)

According to Appleseed, average university wages are seven percent higher than the regional average. Comparing the amount of wages from the Boston universities to data from the United States Census Bureau, Appleseed found that the universities were responsible for 2.4 percent of all wage and salary payments in the five counties surrounding Boston. The employees spending benefits local businesses since 88 percent of the universities' employees reside in the Boston metro area. Employment by the research universities are less susceptible to swings in the economy. When Boston saw

total employment decline by 2.8 percent, the universities increased their payroll by four percent (Appleseed, 2003).

2.2.2 Direct Expenditures

Another way the SLF brings money to the local economy is through direct expenditures on goods, services, and construction. Significant factors to consider when assessing direct expenditures involve total money spent, what vendors receive the money, and the location of the vendors. The money that is spent locally boosts the local economy by supporting businesses and creating jobs. For example, UC Berkeley spent over $250 million, 42 percent of its budget (see Figure 2.2.2), at businesses located in the local Bay Area in 1998-1999 (Sedway Group, 2001).



Sources: Office of Materiel Management, UC Berkeley; and Sedway Group.

Figure 2.2.2: UC Berkeley Spending by Location 1998-1999 (Sedway Group, 2003)

In another example, the 14 colleges of the Worcester Consortium examined the impact of their $879 million in expenditures. While the Colleges in the Worcester Consortium employ 9,380 people, their spending helps to maintain 10,920 jobs in Worcester County and 8,600 jobs in the remainder of Massachusetts (Colleges of the Worcester Consortium, 2001). These numbers are determined by input-output models, which will be discussed in section 2.2.7.

2.2.3 Guests and Conferences

In addition to the SLF's spending and employment, the SLF's guests bring in additional money from outside the region. They come to attend classes and conferences, and while in Davos spend money on hotels, meals, souvenirs, and entertainment. The Colleges of the Worcester Consortium examined this aspect by surveying over 500 students to determine the amount of money spent by the students and their guests. They

used the results to determine that the visitors to the 14 colleges of the Worcester Consortium spent approximately $50 million on hotels, meals, and entertainment in 2001 (Colleges of the Worcester Consortium, 2001).

2.2.4 Impact on Government Finances

While some organizations do not directly contribute to government finances, its employees remain subject to taxes. The 14 colleges of the Worcester Consortium do not pay property taxes to the city of Worcester or the surrounding cities. However, data from the U.S. Census Bureau and college records show that the colleges are responsible for generating 3.1 million dollars in property taxes from the employees who live in Worcester County (Colleges of the Worcester Consortium, 2001). The Swiss national government funds the SLF, therefore contributions to government finances are small. However, its employees still must pay taxes on their salary and property at the cantonal and communal levels.

Taxes resulting from sponsored activities, such as conferences, are another way that the SLF contributes to the local government. The Museum of Fine Arts in Boston claims that 1.6 million dollars is raised on sales tax and meals taxes from the Museum's food service and retailing operations. When employees' wages and hotel taxes are figured in, the Museum generates two million dollars for the city of Boston and nine million for the state of Massachusetts (Mt. Auburn Associates, 2003).

The total direct impact of the SLF is the result of taking into consideration all of the employment, direct spending, spending by guests, and the impact on government finances. However, economists agree that the economic impact of an organization, such as the SLF, is greater than the total of that organization's direct impacts. This is known as the multiplier effect.

2.2.5 Multiplier Effects

The multiplier effect is an economic concept that refers to the effect from continuous re-spending of incomes. When an injection of expenditure into an economy leads to an increase in national income more than the original injection, this is the multiplier effect (Choi, 2002). Motiva Enterprises illustrates the multiplier concept in Figure 2.2.3. Motiva's direct expenditures are disbursed in five different ways. The three local recipients of the disbursement will continue to spend this money in the same

five ways over successful rounds of spending. It is termed the indirect effect when businesses spend this money, and the induced effect when employees spend this money. Money that flows to non-local government and non-local leakages such as purchases from non-local suppliers and employees, are lost. These successive rounds of spending ripple through the economy and magnify the impact of the initial round of spending (University of Delaware, 2002).

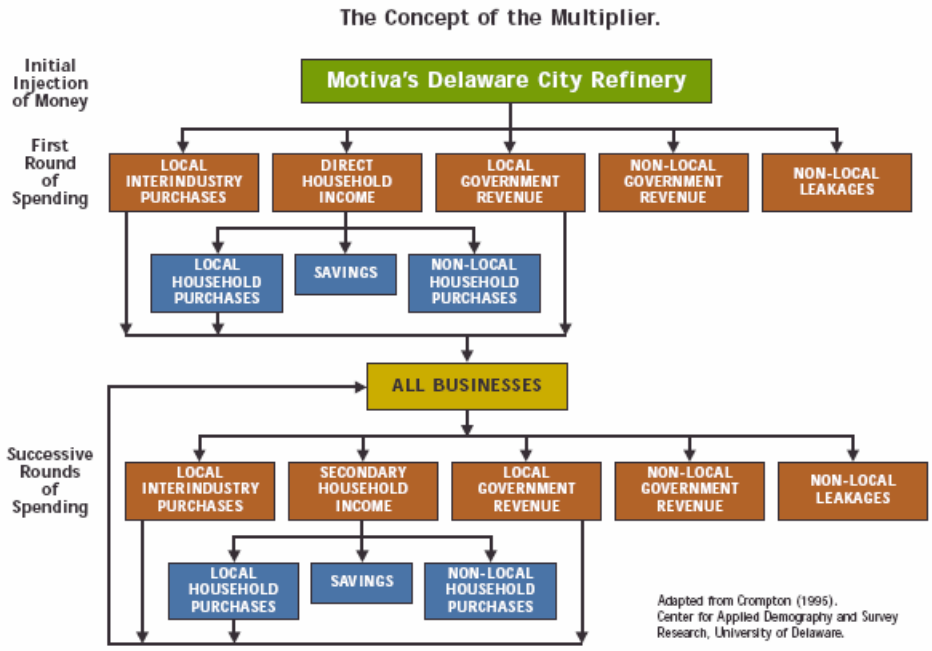


Figure 2.2.3: The Concept of the Multiplier (University of Delaware, 2002).

2.2.6 Input-Output Models

Input-output models are used to determine the multiplier effects. The Colleges of the Worcester Consortium used the Regional Input Output Modeling System (RIMS II), an input-output model developed by the U.S. Department of Commerce, to determine the multiplier effects (Colleges of the Worcester Consortium, 2001). This model organizes the economy into over 500 separate industries and contains comprehensive data for regions within the United States (U.S. Department of Commerce, 1997).

The Colleges of the Worcester Consortium's direct expenditures of $1.134 billion generated an additional $865 million in indirect and induced spending (see Figure 2.2.4). In order to obtain this figure, the direct expenditures of the colleges were organized into the same categories as the RIMS II industry classifications. The RIMS II tables for the

Worcester County and for Massachusetts were then used to obtain the multiplier in each industry. The multipliers are then applied to all of the direct expenditures from the colleges to obtain the total indirect and induced impact (Colleges of Worcester Consortium, 2001).

Figure 2.2.4 Colleges of the Worcester Consortium Total Economic Impact (Colleges of Worcester Consortium, 2001)

Input-output models account for inter-industry relationships within regions. These relationships largely determine how regional economies are likely to respond to project and program changes. They avoid aggregation errors, which often occur when industries are combined in simpler models. Models such as RIMS II can be used to predict the total economic impact of an industry or organization within ten percent of the actual impact, which can only be determined using expensive survey techniques (US Department of Commerce, 1997).

Input-output models have some limitations. First, they deal only with quantifiable impacts like spending and employment. They do not account for social or educational benefits. They cannot take changes over time into consideration and instead assume that relationships between economic sectors are fixed. Lastly, input-output models do not account for additional capital required to support indirect and induced expenditures. For example, an input-output model would include the health service employment required to care for a community with an increased employment base, but not the capital expenditures required to provide the health service facilities (Sedway Group, 2001).

To determine the total economic impact of an organization, both the multiplier effects and the direct impacts must be analyzed. Not all of the impacts of the SLF are as

easily quantified as the economic impact, however. In the following sections, we will look at how the other categories can be described.

2.3 Educational Contributions

In addition to contributing to the local economy, the SLF provides a variety of educational services. One significant service provided by the Institute is the education of doctoral and undergraduate students. The SLF works in conjunction with cantonal universities to grant these students experience in hands-on research. Neither the institute nor Graubünden are compensated for this educational service. The SLF also provides services typically associated with research institutions and universities, such as the benefit of the expertise in the organization. They also provide several services unique to their field such as educating the public about the research conducted in Davos and increasing public awareness of avalanches.

2.3.1 Contributions to Swiss Universities

The educational system in Switzerland at the colligate level (the equivalent of high school in the United States) is structured as follows. Students that want to continue their studies beyond college, while remaining in Switzerland, must attend one of the cantonal universities. Programs range from highly selective disciplines such as those in medicine to less selective ones such as some technical fields. Once students are accepted into a university, their tuition is funded by the canton they reside in. This funding comes from the taxes that are paid by the residents within that canton. The tuition for the students goes to either the cantonal government or the federal government that is responsible for funding the university the student attends (Swiss Education, 2003).

There are no universities within the Canton of Graubünden, therefore there are no resources entering the Canton for the purposes of higher education. However, Graubünden spends money for each of its students pursuing education at universities in other cantons. The SLF currently employs 29 PhD students and 7 diploma students who are partially receiving their education from the SLF, while their tuition remains entirely reserved for the universities. Students learning from and using the resources of the SLF are not subsidized at all.

2.3.2 General Educational Services

The general educational services the SLF provides to its community are similar to those provided by an university. The SLF's expert staff contributes to the community through their research. The Institute also provides benefits through the many conferences it hosts for businesses and research organizations as well as the courses it offers for people interested in learning about the technology and the knowledge that the SLF has.

The Institute developed an educational relationship at the university level through volunteering its specialized personnel and equipment for the education of university graduate students. The SLF takes on students interested in the field of snow and avalanche research and gives them real-world, practical experience in the discipline. It does this through its graduate program for research as well as through the graduate courses it offers.

The Institute also offers educational classes and conferences. Students, fellow engineers, and anyone interested in learning enroll in a wide variety of courses, ranging from conferences on permafrost to courses on soil stress and strain. This part of the SLF acts as a college and educates many doctoral students from surrounding universities. The SLF also maintains a library with over 5000 technical books and publications in the field of snow and avalanche research. The library contains subject matter such as winter and accident reports, publications of conferences and the reports on topics relating to snow and avalanche research. The library primarily serves the SLF researchers, but is open to anyone who chooses to enroll. This is another example of how the SLF contributes to the educational programs of cantonal universities as well as to the education of the general public.

2.3.3 Specific Programs

In addition to providing the general benefits typical of research institutions, the SLF offers many programs, including the Open House and *Public Guidance*. The SLF holds open house days, and opens its doors to the public and invites people to come and learn about the research performed there. They put on interactive presentations, slide shows, and take the opportunity to answer questions the public may have about the research conducted. A similar program, *Public Guidance*, focuses more on the research institution, as participants are given walkthroughs of current and past research projects.

These programs serve to increase public awareness of the research facilities at the SLF and why they are important.

The Winter Experience Path and the Mountain Experience Path are public programs offered by the SLF that have been successful in educating the people of Switzerland about their surroundings. These programs consist of a guided walk in the mountains where the participants are taught about snow and wildlife using creative methods that attempt to convey essential information to people who do not posses a scientific background. The outdoor surrounding helps create an environment that tries to stimulate questions from the participants that may not otherwise have been addressed.

2.3.4 Educational Impact Case Study

The Colleges of Worcester Consortium conducted an analysis, similar to ours that described the benefits that colleges offer the community. One important advantage the community gains from the colleges of Worcester is the experience and expertise of the faculty. The faculty supports local businesses by conducting direct research and consulting. Members of the community benefit from the faculty's excellence in the arts and research (Colleges of the Worcester Consortium, 2001).

The analysis of the Colleges of the Worcester Consortium discussed benefits in "Training and Retraining." The colleges provide courses and conferences for businesses that want to educate their employees in a specific area, as well as people that wish to learn something new in a field. Another educational benefit addressed in the impact analysis was partnerships with schools. The Colleges of the Worcester Consortium have developed an educational relationship with public schools through various volunteer programs in which college students assist public school students in need of academic support.

The majority of the data used for the Colleges of Worcester Consortium Impact Analysis was obtained through surveys that were distributed to each college in the Worcester Consortium asking the responsible offices specific questions about the types of social events the colleges were involved with, the credentials that were held by the faculty members, and more information for characterizing the universities educational contributions. These questions aided in the study by providing data and specific instances that convey the benefits of the colleges.

2.4 Social Impact Analysis

The SLF is responsible for many social contributions, in addition to the recognition, economic benefits and educational services that it brings to the region. We focused mainly on how SLF's research attempts to prevent injuries, deaths, and damages as a result of avalanches. Conducting research that potentially could be attributed to saving lives is important in the social impact of an organization.

Social impact analysis studies the potential personal benefits and consequences that result from a change. This 'change' represents anything from the construction of a new dam, restaurant, or the addition of a research institution. To analyze the impact of the SLF, one can observe the organization according to the comparative diachronic model by viewing the effected areas at two points in time: before and after the Institute was founded (Burdge, 1994). This is beneficial to the analysis because it compares aspects of the community before SLF arrived to aspects of the community after the Institute began its research. This type of comparison eliminates changes that may arise from culture to culture. Not all research institutions have the same effect in all locations. For example, it would not be useful to investigate the social impact analysis of an avalanche research center in Florida, and then compare it to the SLF to predict the Institute's effects on Switzerland.

One of the primary services the SLF provides is the Avalanche Bulletin. This extension service is internationally recognized. Formed with the intention of creating public awareness of avalanche danger in Switzerland, it has also brought media attention to Davos through news broadcasts on radio and television, as various news crews come to the SLF in Davos to report on their services. The bulletin informs the public on snow and weather conditions, in addition to avalanche risk factors in particular regions. It is broadcasted in several ways, including radio, television, fax, and Internet (Swiss Federal Institute for Snow and Avalanche Research, 2003).

To evaluate the social impact, it was useful to examine the effects of the avalanche bulletin. From 1937 to 1999, there were 1,592 recorded deaths due to avalanches. While fatalities have increased since the SLF began the warning system, average deaths per population have decreased (Tschirky, 2001). This is due to the dramatic population increase that occurred during this period. In 1950 there were roughly 4.7 million people living in Switzerland, compared to 7.2 million people in the year 2000 (Swiss Federal Statistical Office, 2003). This population increase does not reflect the

increase in tourism. In addition to Swiss residents, there are presently close to 120 million visitors each year (Goodman, 2000). It is important to realize that the SLF does not directly save people's lives. However, their research attempts to improve safety in the mountains; therefore this is considered in the social impact.

2.5 Research Questions

The issues addressed in this chapter present several questions. Other institutions have answered these questions in various studies, but, to date, there has not been a study on the SLF's impact. Outlined below in Table 2.5.1 are the research questions we addressed in evaluating the services of the SLF, as well as many of the sub-questions that were answered in doing so. In the following methodology section, we describe the approaches we took in dealing with each of these issues.

Table 2.5.1: Summary of Research Questions

How Does the SLF Gain Recognition?
How does the SLF gain peer recognition? How does the SLF gain community recognition? How does the SLF gain professional recognition?
What is the Local Economic Impact of the SLF?
Where Does the SLF's Funding Come From? What is the Impact from the SLF's Employment? What is the Impact from the SLF's Expenditures? What is the Economic Impact from the SLF's Guests?
What Educational Benefits Does the SLF Provide?
What is the Impact of the Educational Contributions to Universities? What Educational Programs are offered by the SLF? How beneficial are these services?
How Does the SLF Affect the Community?
How does the SLF communicate with the public? How does the SLF contribute to minimizing avalanche accidents?

3. Methodology

Our background research identified several research questions (see Table 2.5.1) to describe the impact the SLF has on Davos, Graubünden, and Switzerland. We used interviews, SLF records, and two original surveys to answer the research questions. This chapter will explain why specific sources were chosen and the process used to analyze the data.

3.1 How Does SLF's gain Recognition?

Although it is difficult to quantify the recognition of a technical institution, it is a topic that merits attention. We adapted some of the approaches other organzations used for our analysis of the recognition that the SLF generates. To establish the SLF as an internationally recognized research institute, we looked at ways the SLF gains peer, community, and professional recognition.

3.1.1 How does the SLF gain peer recognition?

The first source we used to analyze peer recognition at the SLF was a study called "Peer Review 2001." This study, performed in 2001 by representatives from around the world, examined the SLF according to the quality of research, among other factors. We summarized the important points from this study to emphasize that the SLF's peers respect the Institution as a leader in snow and avalanche research.

The number of journal publications from an institute also can be associated with a certain level of recognition. The SLF's colleagues in the field of snow and avalanche research relate the Institute's name to the various number of journal articles published. To obtain number of journal articles, we examined existing SLF data. On the WSL website, there was a comprehensive list of all publications associated with the organization. After compiling the list, a senior scientist at the SLF determined how many articles originated from the SLF exclusively. Information was only available dating back to 1998. We examined each year and compared it to the average number of articles per year.

Another way the SLF gains recognition by its peers is the amount of grant money the Institute receives. Grant money is used on research projects in various fields of study. We examined the funding the Institute receives to determine grant money. This document was obtained from the director of the SLF's finances.

3.1.2 How does the SLF gain community recognition?

The SLF provides services that are internationally known and respected. It gains recognition through their avalanche warning service. Manfred Steiniger, an employee from the SLF Department of Avalanche Warning and Risk Management, provided us with a spreadsheet illustrating the number of times the avalanche bulletin was accessed within the past 8 years. The information was subdivided into the different ways it was accessed, such as telephone, fax, Infobox, or Internet. We also examined a survey that had been offered on the SLF's website to determine how people feel about the SLF's online services. After analyzing the data, we created new charts to highlight how the avalanche bulletin and internet service creates community recognition for the SLF.

3.1.3 How does the SLF gain professional recognition?

The SLF gains recognition on the professional level through appearances in the media. The media approach and reference the SLF because they respect it on a professional level. Researching records the SLF keeps on newspapers, radio, and television appearances were the best way to determine the amout of attention the SLF receives in the media. Because the SLF has kept good records on this subject, additional interviews or research outside of the SLF was not necessary and would not give us any additional information. Therefore, our first step was to approach SLF employees. We consulted the SLF and requested any possible records of media attention they have received. We gathered information regarding appearances on two local radio stations, DRS-1 and DRS-3. Also, the Director of the SLF, provided us with a report that illustrated the amount of times the SLF was on national and international television stations. We organized the existing data into charts and tables to examine trends over the years, and demonstrate that the SLF is often referred to by the media.

3.2 What is the Local Economic Impact of the SLF?

The SLF affects the economy in a variety of different ways. In an attempt to quantify these affects, we answered the research question, what is the local economic impact of the SLF? We expanded this to more specific questions that have been implied in our literature review and focus on the economic impact from sources of funding, employment, direct spending, guests spending, taxes, and indirect effects. We examined several sources, such as SLF records, the Swiss Federal Statistic Bureau, our survey of

conference guests, and our SLF employee survey to quantify and analyze the economic benefits of the Institute in terms of Swiss Francs and jobs created.

3.2.1 Where Does the SLF's Funding come from?

The director of the SLF's finances in Davos provided us with the breakdown of funding from the federal government and private investors since 1990. We reorganized this data into graphs that categorize the different sources of funding and show their development over time. In addition to the trends in funding sources, we also revealed the breakdown of funding that comes from within and outside of the Canton. To accomplish this, we obtained a list of the private investors and determined those that were located within Graubünden. We were then able to show the percentage of funding that came from outside the Canton for the year 2002, which was the most recent, complete year that data was available for the SLF.

It is appropriate to make generalizations about the SLF using data from 2002 because the funding and expenditures were similar this year compared to previous ones. It is also apparent when looking at successive years, that the budget is most similar to the preceding year. For example, analyzing data from 2002 is suitable, given that it is the most accurate data for making future predictions regarding the SLF's finances. We will now discuss how we obtained and used this data in the methods for the analysis of the SLF's employment.

3.2.2 What is the Impact from the SLF's Employment?

Our main source for determining the impact from the Institute's employment was SLF records. We obtained data in two separate lists that showed where each employee lived and what their position was. We also attained the total amount of wages paid out by the SLF, and the average salaries for the various positions. We obtained this data from the director of the SLF's finances. We recoded the data so that it showed the number of people in each position that live in Davos, other Graubünden, and other Switzerland. Using average salary by position, we determined how much wages were paid to each area. We created graphs (see Section 4.1.1) to show the total salary paid out to each area by percentage and total amount of Swiss Francs.

In order to compare the SLF's employment with the rest of Switzerland, we obtained average salary information for Graubünden and Switzerland from the Swiss

Federal Statistics Bureau website. The average salary at the SLF was compared to that of Canton Graubünden and all of Switzerland. The last indicator under employment that we quantified was recent trends in employment at the SLF. We received a list of how many people the SLF has employed each year since 1990 toexamine how the SLF's employment has changed.

Multiplier Effects

The indirect effects of the SLF's employment are also an important consideration. Economic base models have often been used to estimate the how many jobs are created indirectly. To calculate how many jobs are created indirectly by the SLF's employment, we used these models.

Economic base models are older and less advanced than input-output models. They divide the regional economy into two sectors. Basic industries depend on markets outside the region while service, or non-basic industries, depend on the markets within the region. Total economic activity is considered a function of basic activity (University of Victoria 2003).

The employment multiplier is defined as the total number of jobs in the region divided by the number of basic jobs in the region. There are several different techniques available to determine which positions are basic and which are non-basic. The most involved is to survey all or a portion of the businesses in the region to determine how much of their organization is basic. This is expensive and time consuming and is seldom done.

The least involved method is to assign industries or parts of industries to basic or non-basic sectors, using the nature of the industry. The location quotient method is slightly more complicated, and is likely responsible for the continuing popularity and use of economic base multipliers. The location quotient (LQ) is defined as the ratio, $(e_i/e)/(E_i/E)$, where e_i is area employment in industry i, e is total employment in the area, E_i is employment in the benchmark economy in industry i, and E is total employment in the benchmark economy. The "benchmark" economy is generally the nation, which is the closest available approximation to a self-sufficient economy (Schaffer, 1999).

If the location quotient for a specific industry is less than or equal to one, the industry does not or barely meets the expected demand for the given good or service in the local economy. All employment is considered non-basic since it is supplying the demand for that good or service.

If the location quotient is greater than one, then some of the employment in that industry is basic since it is larger than would be expected. (Florida State University, 2003) The basic employment is calculated by the formula, basic employment equals $(1 - 1/LQ_i)*e_i$. The multiplier for the employment is then equal to all the basic employment in the region divided by the total employment for the region.

The assumption technique and the location quotient technique can be combined to produce more accurate and complete results. Some industries can be clearly defined as basic or non-basic, regardless of what their location quotient is. For example, hotels clearly serve a non-local demand and can be assumed to be a basic industry.

We used a combination of the location quotient and assumption techniques to determine the employment multiplier. We obtained data on the number of jobs in each industry in Davos and for all of Switzerland from the Swiss Federal Statistics Bureau. We used these numbers to determine the location quotient for each industry. For industries with a location quotient greater than one, the amount of basic employment was calculated. We then combined the assumption technique with the location quotient. For industries such as hotels, which primarily serve non-local demand, we assumed that all employment was basic. We then determined the employment multiplier for Davos by dividing the total number of jobs by the basic jobs in Davos. We multiplied the number of employees at the SLF by the employment multiplier to determine how many jobs are created as an indirect effect of the SLF's employment in Davos.

To calculate the induced effect when the SLF's employees spend their money, we decided to use a survey of the SLF's employees to gain a much more accurate estimate then we could with economic base models. The details of our methods to determine employee spending are detailed next. The employees' money goes to two main areas. First is the consumption of the employees, both inside and outside of Davos. We estimated how much money the employees spent with our employee survey. Secondly, the employees must pay income taxes.

Employee Consumption

Mattia Wegmann, a Ph.D. student studying Davos' economy, provided us with a list of consumer spending by socioeconomic class from the Swiss Federal Statistic Bureau. However, this information was organized by households and was not completely appropriate for determining the spending habits of individual SLF employees.

In order to determine the consumption of the SLF employees, we asked all of the employees to fill out a survey (see Appendix B). In the survey, employees described their spending habits as they occur inside and outside of Davos on a monthly basis. We coded the responses by type of position and by home residence of the employees. We determined the average spending inside and outside of Davos according to both position and home residence. For example, one category that the surveys would be coded into was graduate students that lived in Davos. We multiplied the averages in each category by the total number of employees that fell into that category. Summing all of the categories together, we obtained estimates for the amount of money the SLF's employees spend, both inside and out of Davos.

Income Taxes

We determined that the main effect that the employees have on the local government is through the income taxes they pay. Property taxes are relatively insignificant and would also be very difficult to estimate without violating the privacy of the employees.

To evaluate the impact of the SLF on government finances, we examined tax information from the Swiss Federal Tax Administration and the Graubünden Tax Administration. Websites for both organizations had income tax calculators. The Graubünden Tax Administration tax calculator contained tax rates for each individual community in Graubünden. We obtained the tax rates for Davos, and entered the percentage of income that goes to Davos on the Swiss Federal Tax Administration calculator. The Federal Income Tax Calculator was more appropriate to use since it automatically calculated deductions that the average person claims.

We entered the average salaries that we obtained from the director of the SLF's finances into the Swiss Federal Tax Administration income tax calculator. This gave us the average income tax paid to Davos, Graubünden, and the Swiss Federal government for each position at the SLF. We multiplied these values by the number of each position that live in Davos to obtain the amount of taxes paid by SLF employees that live in Davos. We followed the same procedure with the different cantons and communities that SLF employees reside in to obtain the amount of taxes paid to different cantons, communities, and the federal government by SLF employees that live outside of Davos. We graphed the different amounts of taxes paid to each area to display the effect that the SLF employees have on the government (see Chapter 4). In addition to the spending of

employees, the SLF's spending has a significant effect on the local and Cantonal economies.

3.2.3 What is the Impact from the SLF's Expenditures?

We evaluated several aspects of the Institute's spending to show how the SLF affects the economy. To determine the amount of money being spent within Davos, we examined where the SLF allocates its resources through expense reports. We obtained a summary of the SLF's expenses over the last three years. We also acquired a list from the director of the SLF's finances displaying the companies that the SLF does business with in Davos and the total amount of Swiss Francs paid to each. With this data, we calculated the spending inside of Davos. Using the summary of the SLF's expenses, we also determined the SLF's spending outside of Davos. We displayed the breakdown of this spending by location using a pie chart. Using the list of expenditures in Davos, we also examined the types of businesses the SLF deals with to better gauge the Institute's effects on various industries in the area.

Multiplier Effects

For Switzerland, no reliable input-output models were available at the time of analysis. The only one available was a relatively poor adaptation of a German model and would not be accurate for the economy of Davos. We found economic base models were acceptable for calculating the indirect effects of employment, which will be described in the next section. However, economic base models are not generally used for multiplier effects of direct expenditures and the data to calculate the multiplier in Davos was not readily available.

The best way to estimate the indirect effects of the SLF's direct expenditures was to use a multiplier that had already been determined for a similar economy. The Canton of Valais performed a study in 1999 and 2000 that calculated the direct and indirect effects of tourism within different parts of the Canton. Upper Valais has an economy that is consistent with that of Davos. Therefore, the multiplier obtained in Upper Valais is comparable to that of the multiplier in Davos. We used this multiplier to determine the indirect effects for the direct expenditures of the SLF within Davos. We adapted this method to determine the direct and indirect effects of the SLF's guests spending as well.

3.2.4 What is the Economic Impact from the SLF's Guests?

To determine the impact from the SLF's guests, we used employee interviews, tourist information, and a workshop survey. No single department or position at the SLF is responsible for organizing conferences. The administrative secretary maintains the most comprehensive list of conferences, but additional interviews were required to obtain complete information on the conferences. Employee interviews with the staff members responsible for organizing conferences were used to obtain how long each conference lasts and the number of guests that come to Davos for the conferences sponsored by the SLF.

We then estimated the average spending of the guests that visit the SLF. The first source we used for this was the comprehensive tourism study performed in 1999 and 2000 by the Canton of Valais. As stated earlier, Upper Valais has an economy very similar to that of Davos. Therefore, it is a relatively good assumption that what a tourist spends in Upper Valais is similar to what a guest spends in Davos. From this study, we obtained average hotel prices and average tourist spending per day.

To make this information more specific to the SLF's guests, we administered a workshop survey on November 13-14, 2003 during the SLF's AVAL-1D User Group Workshop. On the workshop survey (see Appendix B), we asked where each guest came from, how long guests are staying for the workshop, and their approximate spending habits while in Davos. This workshop is not representative of all conferences, but the guests that come to the SLF are similar since they come for similar reasons. We altered the average spending habits of tourists from the Valais study to more accurately reflect the responses from the survey.

We used the number of days a conference lasts as the number of days a visitor spends in Davos. We assumed that most guests come only for the conference, arriving the day it begins and leaving the day it ends. However, we realize that many guests will stay longer after the conference or will arrive the night before the conference begins. Using results from the workshop survey and information from interviews with SLF employees, we estimated that a certain percentage stay for one extra night. We then multiplied the number of days a SLF guests spends in Davos by the estimated spending per day of that guest and multiplied the number of nights determined by the average hotel price to obtain the total amount of money spent by SLF guest while attending conferences in Davos.

Multiplier Effects

Like all spending in the Davos economy, the money that SLF guests spend in Davos will also create indirect and induced effects. Again, we turned to the study done by The Canton of Valais. The multiplier determined in this report was determined specifically for tourism in an economy that is similar to Davos. Therefore, this multiplier will be a good estimate for the spending of tourists, or SLF guests, in Davos. We multiplied the spending by the SLF guests by the multiplier from the Valais study to determine the indirect effects created by the SLF's guests.

3.3 What Educational Benefits Does the SLF Provide?

The SLF provides several educational services, including classes, seminars, and programs in place with universities. These offer a wealth of information to the people of Switzerland. We quantified the services to the universities in terms of Swiss Francs to illustrate the economic contributions the SLF provides to Switzerland's educational system. We also added qualitative information about the SLF's educational benefits by collecting information about their services to the community and evaluating their effectiveness.

3.3.1 What is the Impact of the Educational Contributions to Universities?

We quantified the SLF's educational contributions to the universities in CHF for their role in educating students for which they are not subsidized. To quantify these contributions, we first investigated the cost of educating a student at a university (this varies depending on university and field of study). We obtained this data through the Cantonal Government Department of Education. They provided the number of students the canton sends to universities and the costs for sending them. We calculated the relationship between the amount of money spent for tuition and the duration of study. We next examined how many students the SLF educates, the duration of their studies at the SLF, and what university they attend. We received this information from Dr. Veronika Stöckli, Director of the Alpine Environment Division at the SLF. She supplied us with records of all the students that were studying at the SLF, what university each came from, and the duration of time they had been at the SLF. We then compiled a list linking the time students spent studying at the SLF and their perspective universities. Once we obtained all the required information, we quantified the contribution of the SLF

by relating the cost of educating a student for a fixed period of time with the time the student spends at the SLF. The data and results are presented in the form of tables and charts, concluding with a final monetary value of the educational contributions of the SLF.

3.3.2 What Educational Programs are offered by the SLF?

We looked carefully at the many services the SLF offer in order to effectively evaluate each one. We interviewed employees of the SLF who are directly involved with the programs to ask questions about how they work and the type of information each one conveys to its participants. Several educational programs are not very centralized, and there is no one person or office to record all the required information. As such, it was necessary to find those most involved with each program for data or referrals to those that were able to help us with more specific information (attendance information, survey returns, etc.). We asked the SLF about these services because they possessed the most comprehensive data, and we wanted to get a sense of the mission in offering each service. We obtained information about what programs were offered, their content, how frequent they occurred, as well as additional information about the mission statement and the goals of the programs. We compiled this information into anecdotal data that conveys the educational benefits the SLF provides.

3.3.3 How beneficial are these services?

To determine the effectiveness of each of the services, we used SLF records and the workshop survey. We first examined SLF records that we obtained from the employee interviews to look at any type of evaluations the SLF currently has on the programs. We acquired people's responses to the different programs and their judgment of their effectiveness.

We also used the workshop survey (see Appendix A) to obtain a large amount of data on one particular course the SLF offers. Since the workshop took place while we were in Davos, it was easy to collect a large amount of data in a short amount of time. The survey was handed out to workshop participants and collected from them in the following day. We illustrated a specific instance where people have benefited from the SLF's programs, which reinforced the qualitative information in our report.

Collecting data from the SLF and the workshop survey were the preferred methods for this portion of the project because we collected a large amount of information in a relatively short amount of time. If we had conducted interviews with a random sample of people, our sample size would have been greatly compromised, and we would not have as comprehensive a set of data as with the survey. Focus groups did not apply in this case, as we were not seeking the anticipated response of a target audience, but rather gauging the success of the SLF's educational programs. Using the SLF records and the workshop survey, we showed how well the programs communicate information to the participants, which is indicative of their effectiveness.

3.4 How Does the SLF Affect the Community?

In answering this question we considered if the lives of the public would be different if the SLF were not around. Whether in a large or small way, does the SLF play a role in the lives of the Swiss? It was then our job to characterize this impact and include it in the full analysis of the Institute. We chose to focus this section of our analysis on how much money and how many lives have been saved due to the work of the SLF. We addressed the question: How has the SLF contributed to preventing avalanche deaths and damage? We present our approach to answering this in the following section.

3.4.1 How does the SLF communicate with the public?

To answer how effectively the SLF reaches the public we examined how often the avalanche bulletin was accessed. We interviewed Manfred Steiniger in the Avalanche Warning and Risk Management department of the SLF. He provided us with a spreadsheet of total times the avalanche bulletin was accessed since 1996. These statistics were divided into the form it was accessed such as Internet, fax, telephone, or Infobox. This information allowed us to examine the fluctuation of inquiries over the past seven winters. The relay of information from a research institution to the public shows the social impact it has on the people.

3.4.2 How does the SLF contribute to minimizing avalanche accidents?

We began looking at Swiss Statistical data, concerning avalanche fatalities and damage caused by avalanches, to gather useful statistics that would support our argument.

We understand that avalanche death per Swiss residents and tourists have decreased over time. We also recognize that the SLF's research is focused on preventing avalanche damage and fatalities. It is a safe assumption to say that the SLF contributes to a decline in avalanche deaths. However, the complete impact cannot be quantified and will not be included in this report. We obtained this information from the SLF and the Swiss Federal Statistical Office Website. Stephen Harvey, the person in charge of avalanche accident records at the SLF, provided us with the avalanche database. This database has logs of all avalanches since the 1400's. Each avalanche listed, described if roads were damaged, people injured, or if people were killed. From this information, we also were able to tell where the avalanche fatalities occurred: unmonitored backcountry, in buildings, or on roads. The goal is to minimize fatalities of people who are involuntarily exposed to avalanche areas (on the roads or in buildings). This allowed us to determine if the SLF's services are useful and if they affect society.

Another damage caused by avalanches is structural. This type of damage carries a price tag with it. The monetary damage could be significant due to avalanches. The statistical office provided us with estimated y damage in Swiss Francs caused by avalanches since 1977. Data was only available through 1999, which was a limitation in our study.

We have demonstrated the SLF provides services for the community, yet, are they aware of all that the SLF does for them? Do they believe that their research is beneficial and should be furthered? These questions are the foundation of our social impact analysis on the SLF.

4. Data Analysis and Results

In the methodology, we discussed the procedures we used to collect the necessary data for our study. The purpose of the Data Analysis and Results chapter is to show our findings in various forms such as tables and graphs and to discuss our results. The outcome of this chapter is a quantitative description of the impacts the SLF has on the community.

We first examined the recognition and prestige associated with the Institute. We then looked at three different benefits that the SLF brings to Davos and Graubünden. We analyzed the SLF's economic influence on the region, the educational benefits it provides, and the social impact it has on the community.

The SLF is a world-renowned research institution. It has proven itself in the scientific community through its research grants and journal publications. The organization is also recognized to the general public through the avalanche bulletin and media contacts. The economic impact portion of our study is structured around how Davos' economy benefits from the SLF. Specifically, we examined the SLF's sources of funding, the SLF's employment, and spending by the SLF and its guests. The SLF also provides educational services to many people through graduate schooling, public guidance tours, conferences, and workshops. Lastly, the SLF's research and services attempt to minimize avalanche accidents and damage. Their avalanche prevention has a social impact on the community. These individual influences join together to form the SLF's total impact on Davos, the Canton, and Switzerland.

4.1 The SLF is a World-Renowned Research Institute

The SLF is an internationally recognized research center specializing in snow and avalanche research. As such, it brings prestige to Davos on several levels. The Institute is achieves recognition through its work, services it provides to the public, and through its presence in the media. We analyzed how the SLF generates name recognition in each of these ways.

4.1.1 Peer Recognition

The SLF is held by its colleagues in research institutions around the world to be the top in its field. It serves the sciences of snow and avalanche technology as a contributing body through journal publications and the research it conducts.

Peer Review 2001

The Institute plays a valued part in snow and avalanche research on an international scale. In 2001, representatives from several research institutions around the world met to analyze the SLF, based on several criteria. The institutions represented in the analysis were based in Austria, Norway, Switzerland, and the United States. This study was called Peer Review 2001. Among factors considered in grading the institute were its abilities as a publishing institution, the prominence of its research in various fields, and the quality of the research staff of each of its divisions – Avalanche Warning and Risk Management, Snow and Avalanche Research, and Alpine Environment Research.

The study considered each department and where they stood with respect to their colleagues. Overall, the SLF was determined to be "recognized internationally because of its leadership in the area" (Brown et al., 2001). It was found that the SLF's publications were very good, but that there was room for improvement. The significance of scientific developments was found to be excellent as well, with important accomplishments including the SNOWPACK program, micropen, avalanche dynamics modelling, and snow microstructure research.

In addition to rating the Institute for its research quality, the Peer Review also considered its characteristics as an educational organization. In its evaluation, the SLF was found to possess an excellent mentoring program for Ph.D. students, and that the only area with a need for improvement was the classes offered by the SLF for ETH Zurich and other universities in Switzerland. Motivation in the leadership of the Institute was also found to be high, and both division and team leaders were complemented for their success.

Journal Publications

As found by the 2001 Peer Review, the Institute publishes a great deal of work in the form of peer-reviewed journal articles. As part of the scientific community, SLF researchers publish articles relating to their work and discoveries. Other scientists in similar fields of work read these articles and associate the SLF name with the author. This brings prestige and name recognition to the institute and to Davos. In order to find the magnitude of the SLF's publication in detail, we researched Institute publication records. The following table (Table 4.1.1) shows the number of journal publications by SLF employees from 1999 to 2003.

Table 4.1.1: Number of Journal Publications (1999-2003)

Number of Journal Publications by SLF Employees				
1999	2000	2001	2002	2003
32	69	53	63	42
Average Per Year:		52		

As illustrated in Table 4.4.1, the SLF publishes a large amount of work on a consistent basis. This level of publication aids the Institute in showing itself as a leader in its field, but it also allows for the opportunity of sharing its work with others in the same or related fields. The SLF makes a valued contribution to the scientific community.

Proof that the SLF is respected by its peers can also be seen by the amount of grant money that the institution receives. In 2002, the SLF received over two million Swiss Francs in grant money from various organizations (see Table 4.1.2). These organizations respect the SLF's work and aid in furthering their research.

Table 4.1.2 Grant Money from Various Organizations

Grant Money From	CHF
Swiss National Science Foundation	512,205.85
Swiss Agency for the Environment, Forests, and Landscape (BUWAL)	560,500.00
The Swiss Federal Office for Education and Science (BBW)	404,629.00
European Research	629,360.50
Total	**2,106,695.35**

The Institute has established itself as a leader in the field of snow and avalanche research. The publications made each year help to spread this knowledge to others in the field, and further show the SLF's influential position in its field. It is respected by its peers for this work, as shown by the 2001 Peer Review and the grant money it receives.

4.1.2 Community Recognition

As a research institution, the SLF generates a substantial amount of recognition in the community as being a reliable source of information. Through the avalanche bulletin, the Institute has established itself as an expert in the field of snow and avalanches.

The Avalanche Bulletin is transmitted in five different forms. In addition to telephone and internet requests, the Bulletin is available through fax requests and subscriptions, as well as InfoBox. The internet is the most common way the Bulletin is accessed. To determine how the avalanche bulletin has brought recognition to the SLF, we examined the increasing trend in inquiries over the past seven winters. The annual number of inquiries for the bulletin in the 2002-2003 winter season was approximately 2.3 million. This number has increased over 800% since documentation of the inquiries began in 1996, as illustrated in Figure 4.1.1. Also worth noting is the fact that many people accessing the website for Avalanche data rely on it regularly as a source of information.

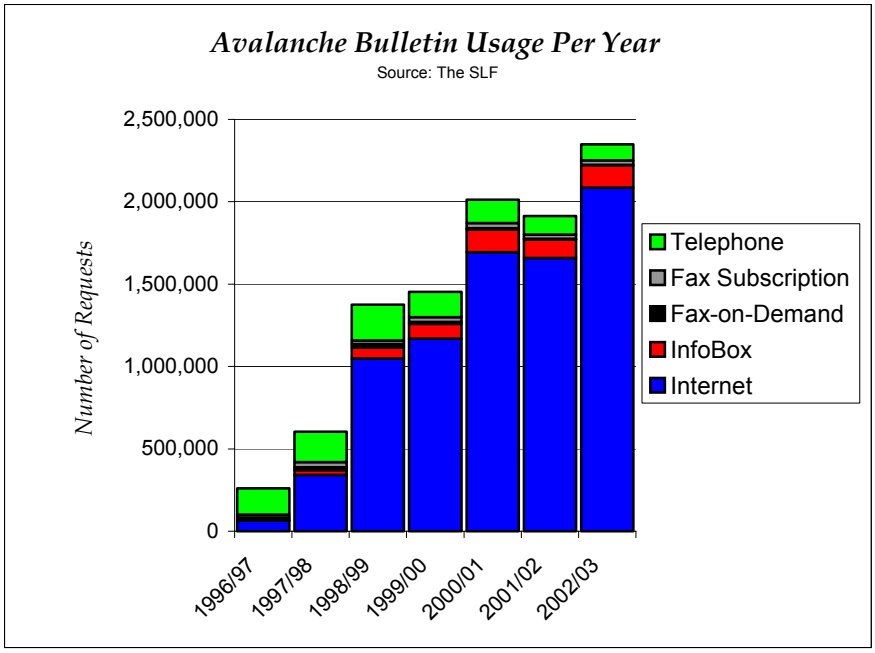


Figure 4.1.1: Avalanche Bulletin Usage per Year (1996-2003)

In May of 2002, the SLF issued an online survey[1] to people who visited the SLF website. The survey began by investigating people's general impressions on the Internet appearance and winter report. In the winter of 2002 and 2003, the Internet accounted for 88.8% of the bulletins total inquiries. The frequency with which the website is accessed is a representation of the recognition the SLF receives from the public. One survey question in particular helps to support this point: when asked how often they visit the SLF website, 84% of the survey sample responded that they visit the site regularly (see Figure 4.1.2). This suggests that people know the SLF and use its services in finding about areas with high risk for avalanches. The SLF has used the Avalanche Bulletin successfully to demonstrate its ability as an expert in snow and avalanches.

[1] This questionnaire has many limitations. It was not advertised anywhere other than the website and was optional to anyone who browsed the page. The survey was not offered in other forms to a strategically selected sample. It is not possible to state if this survey accurately represents the Swiss population.

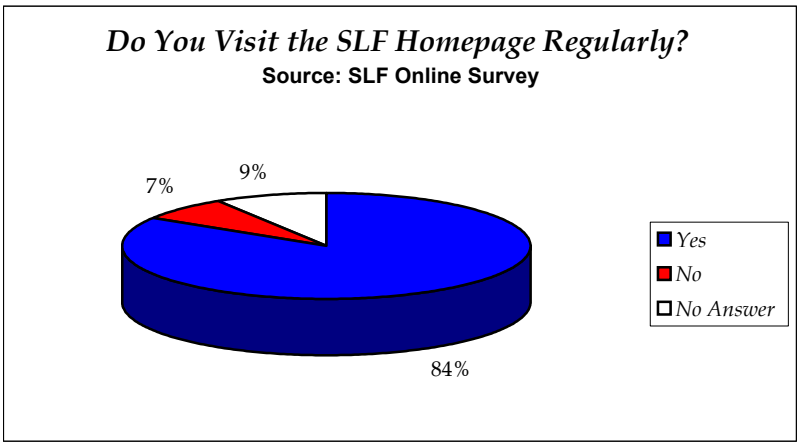


Figure 4.1.2: Do you visit the SLF Homepage Regularly?

4.1.3 Professional Recognition

The Institute also gains professional recognition through its media presence. Whenever avalanche risk becomes an issue, the SLF is the first to be contacted for information on the matter. This results in a presence in the public eye, but also among any groups requiring professional advice or information with regard to snow and avalanches.

Printed Articles

The Institute maintains a large presence in print media. A number of publications such as newspapers and magazines reference the SLF as the primary source of information with respect to avalanche risk areas. In 2002, the SLF was mentioned in 309 articles in a variety of media resulting in over 6.5 million published copies. The distribution increased in 2003 to a total of 283 articles summing over 16.1 million copies published. The sum of these print appearances results in the distribution of over 22.6 million copies of articles in which the SLF is cited. George Gasser conducted a study in which he measured the physical size of all the newspaper articles that referred to the SLF. This figure was multiplied by a standard advertising rate to determine the value of the SLF's press time in print media. The total value was found to be over 11 million CHF. This shows the SLF's prevalence in print media and the level on which they reach people daily with avalanche information

A number of newspapers eagerly display the avalanche bulletin provided by the SLF during the winter. Südostschweiz (Southeast Switzerland) is a newspaper that prints it very regularly and is among the first to get information from the SLF about potential

dangerous situations. The Davoser Zeitung, a local Davos newspaper, prints the avalanche warning twice a week. Both papers question the SLF about the cause and severity of its avalanche warnings in the event of cautions or alerts. This also shows the range of media through which the SLF communicates with the public.

Radio & Television

The SLF is also present in other forms of media. Two methods the Institute uses to reach a wider population are radio and television. The SLF has two radio contacts in with Swiss federal radio. The SLF is on DRS-1 daily with an interview discussing the avalanche hazards there may be throughout Switzerland. The Institute also has similar interviews on a biweekly basis on DRS-3. This is in addition to the other radio contacts in Table 4.1.3. Each of these contacts is used to inform the public about snow conditions and possible avalanche danger. Through the SLF's various media contacts in print, radio, and television, the Institute is able to show itself as a professional source of information regarding snow and avalanches.

Table 4.1.3: The SLF's Public Relations (2001)

Media Contacts					
Print CH	Print Foreign	Radio CH	Radio Foreign	TV CH	TV Foreign
93	4	4	2	13	5

The SLF generates a great amount of name recognition for itself and for Davos as the world leader in snow and avalanche research. The institute does this on a variety of levels, affecting a range of people, increasing its reputation for high-caliber research with every step. Through its research and through the warning service, radio, television, and newspaper contacts, it helps provide a service that many people depend on for vital information.

4.2 The SLF Affects the Economy of Davos and Graubünden

Our data suggests that the SLF has a considerable effect on the local economy. As a world-renowned research institution, the SLF generated 14.7 million Swiss Francs in funding in 2002. It brings a significant amount of money into the region, as 54 percent of the SLF's budget, 7.95 million Swiss Francs, was spent directly in Davos through expenditures and wages. For 2003, the SLF employees will spend an additional 3.85 million Swiss Francs in Davos and pay 1.61 million Swiss Francs in taxes. In addition to

these effects, the Institution also attracted guests who attended conferences at the SLF. In total, the guests spent 407,000 Swiss Francs in Davos in 2003.

All of these categories contribute to the total economic impact of the SLF. In this section, we will show how the SLF affects the economy according to each category. We begin with detailing how the SLF receives its funding. We then examine how this money enters and affects the local economy through the SLF's expenditures and employment. Because the SLF's employees have the largest contribution to the local economy, we will look more closely at their consumption. Lastly, the impact of the SLF's guests will be examined.

4.2.1 The SLF's Sources of Funding

The SLF brings new money to the local economy because they do not draw on financial resources from the local area, but instead rely on sources outside of the region. Before we give details on the SLF's funding, we will briefly explain how the funding of the SLF works.

Funding Overview

The SLF is a subdivision of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL). As part of the WSL, the SLF receives the majority of its funding from the federal government. The funding from the WSL must be used to provide services, such as the Avalanche Bulletin or research that provides some benefit to Switzerland.

In recent years, the SLF has sought to increase its work by seeking funding from third parties. Since 1993, several private corporations, such as Stöckli Skis, and governmental organizations, such as the Swiss National Science Foundation (NSF), the Swiss Agency for the Environment, Forests, and Landscape (BUWAL), and the Swiss Federal Office for Education and Science (BBW) have funded the SLF's research. These sources generally fund specific projects and therefore cannot be counted on to provide funding for long projects or periods.

Funding Details

In 2002, the WSL provided the SLF with a total of 8.9 million Swiss Francs. The SLF received an additional 5.7 million Swiss Francs from third party funding. Lastly, the SLF made 170 thousand Swiss Francs from miscellaneous revenue, such as sales and investments. The SLF's total budget amounted to 14.7 million Swiss Francs.

Only one percent, 44 thousand Swiss Francs, of the third party funding originated from sources located within Canton Graubünden. Figure 4.2.1 shows the breakdown of the SLF's total budget, as well as the locations that third party monies come from.

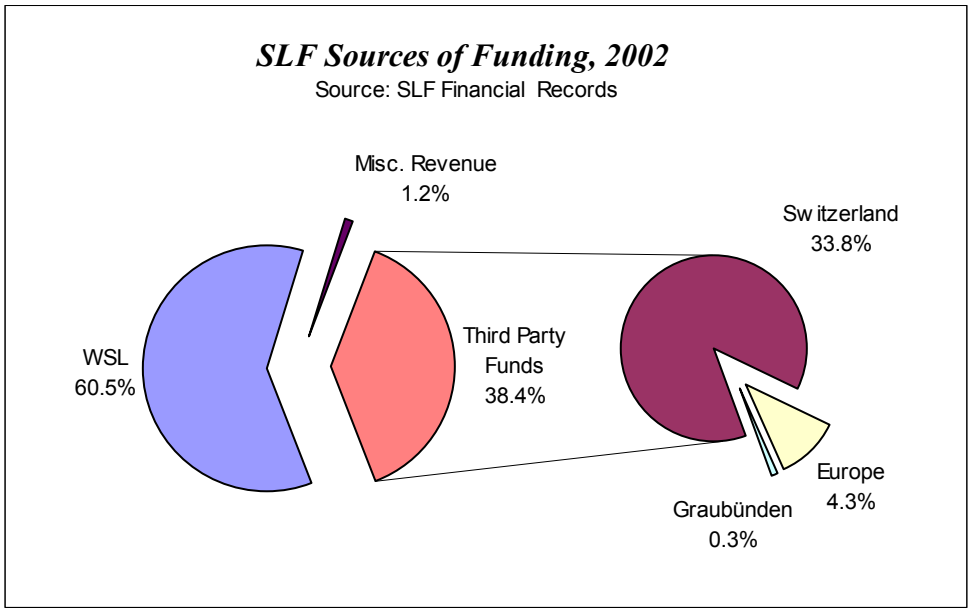
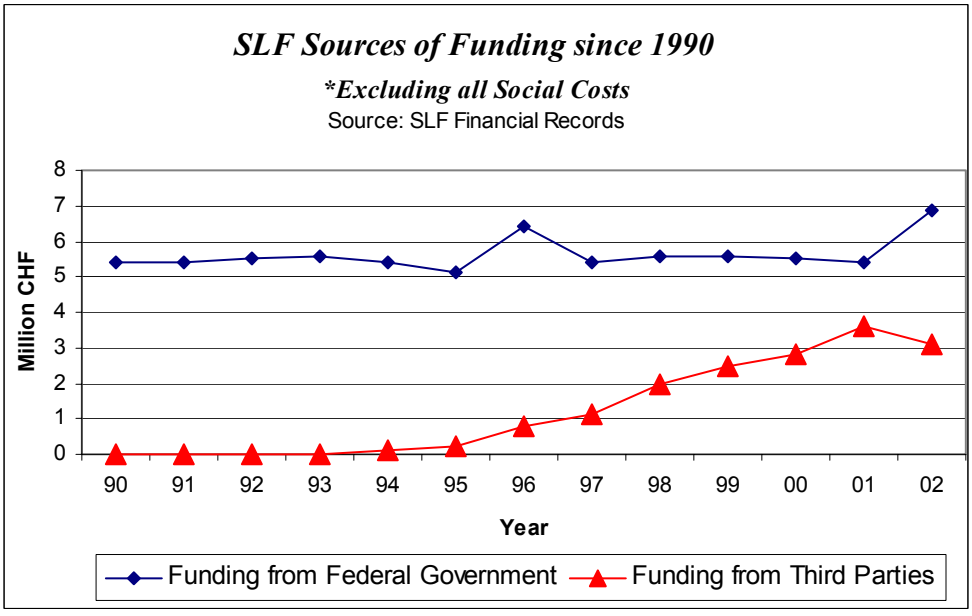


Figure 4.2.1 Sources of SLF funding

Assuming that all sales originate in Graubünden, the SLF receives a total of 78 thousand Swiss Francs from Graubünden, still less than one percent of its total funding. For each Swiss Franc that the SLF receives from Graubünden, the Institution spends CHF 101 on expenditures in Davos and wages to employees that live in Davos.



* In the past, social costs, such as electricity, were paid for separately by the WSL, but are now part of the SLF's normal operating budget.

Figure 4.2.2 SLF funding since 1990

It is also interesting to note that while funding from the WSL has stayed relatively constant since 1990, funding from third parties has grown rapidly since it began in 1993 (see Figure 4.2.2). This has resulted in an equally rapid increase in the SLF's employment (see Figure 4.2.3). This has allowed the SLF's impact on the community to grow as well, since the SLF's employees constitute the SLF's greatest economic impact on the community. The following two sections will show how the employment and expenditures of the SLF are distributed into the economy.

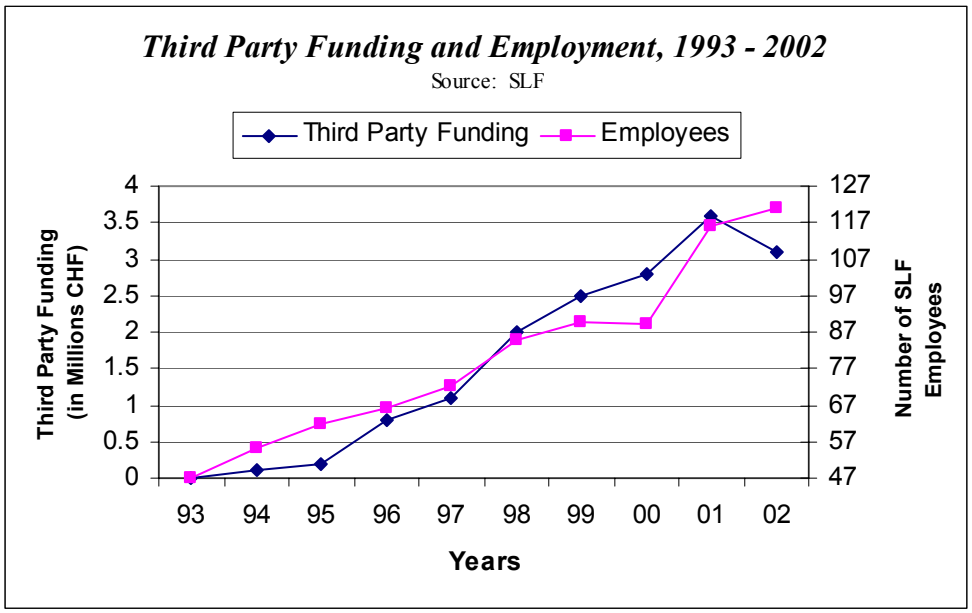


Figure 4.2.3 Third Party Funding and Employment

4.2.2 The SLF's Employment

Out of all of the SLF's economic impacts, the SLF's employees have the largest. The effects of the SLF's employees can be measured in a variety of ways. First, we will discuss the effect of the employment in terms of number of jobs that the SLF provides, both directly and indirectly. We will examine what region the employment effects the most and turn to examining where the SLF's wages are distributed. Lastly, we will look at the consumption of the SLF's employees and determine how much SLF's employees are responsible for in taxes.

Number of Jobs

Research and development plays an important role in Davos' economy. It employs as much, if not more than many other industries in Davos. A comparison of the amount of jobs brought to Davos in 2001 by research and development to other industries is illustrated in Figure 4.2.4. This graph does not include the very large employers in

Davos, such as guest related services and construction, to which research and development cannot compare. In 2001, the SLF employed 116 people, approximately half of the jobs created by research and development in Davos.

Figure 4.2.4 Employment in Davos by Industry Categories

The SLF has not always occupied this large of a position in Davos' economy. The SLF has increased its employment by 196 percent since 1993 (see Figure 4.2.4). This was made possible by the increase in third party funding, and has caused the SLF's economic impact on the local community to enlarge greatly over the last ten years.

Because the SLF is in this state of growth, the number of employees and the employment profile change frequently. From this point forward, we will analyze the SLF's employment as of November 2003. It was beneficial to use the most recent data as a comparison to the information we obtained through the survey that was sent out to the current employees. Had employee data from 2002 been used as in the other parts of the economic impact analysis, we would not have been able to accurately compare it with the answers from the employee survey. In November 2003, the SLF employed 139 people. The remainder of this section will be dedicated to how those 139 employees affect the economy of Davos.

Types of Jobs

The SLF's 139 employees occupy a variety of positions, from researchers and administrators to support staff such as janitors and food service employees. We categorized these various job positions at into five groups. The majority of the workforce is composed of highly educated researchers, post doctorates, and students pursing their

Diploma or Ph.D. (see Figure 4.2.5). The remainder of the workforce, 19 percent, is composed of support staff, such as technicians, janitorial services, and secretaries.

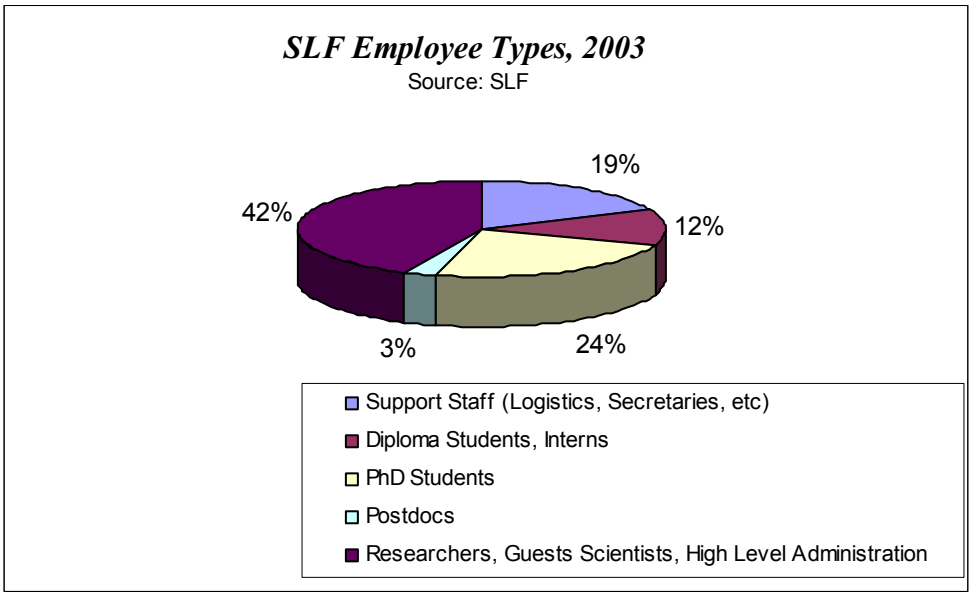


Figure 4.2.5 Type of Employees at the SLF

Home Residence of Employees

Where the employees live is very important to how much impact they have on the region. Eighty-five percent, or 118 of the SLF employees, live in Davos (see Figure 4.2.6) and eleven percent lives in other parts of Graubünden. From the Literature Review, this indicates that the majority of the employees' money is spent in Davos. We will cover this in more detail later, but first we will examine how many jobs are created indirectly by the SLF's employment in Davos.

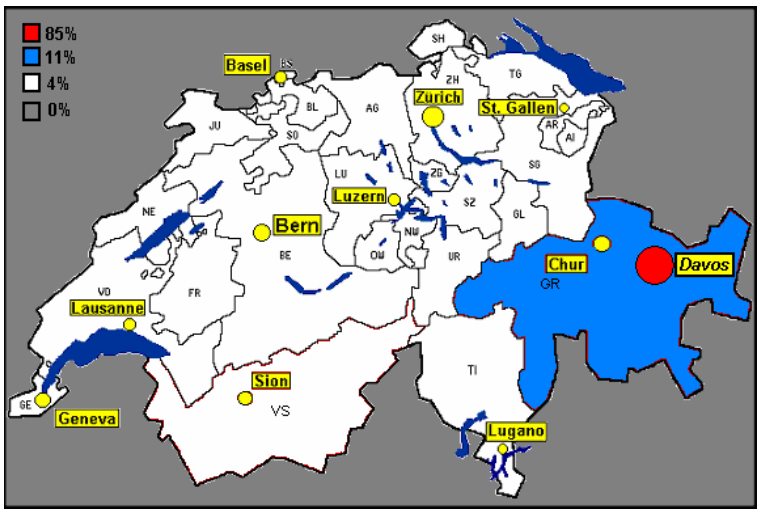


Figure 4.2.6 Locations of Employees

Multiplier Effects

To quantify the number of local jobs that are created as a result of the SLF, we used a multiplier determined from economic base models. Additional jobs are created in Davos aside from the ones supplied directly by the SLF. This is because the staff employed by the SLF that live in Davos require goods and services that will be filled by other industries. For example, there will be an employee at local stores to serve the SLF employees. Using a combination of the location quotient and assumption methods, as described in Chapter 3, we determined that, out of 6,444 total jobs in Davos, 3,636 were basic. Dividing the total number of jobs by the basic number gave a multiplier for jobs created in Davos as 2.19. The result is that 258 total jobs, both direct and indirect, result from the SLF's role in the local economy (see Figure 4.2.7).

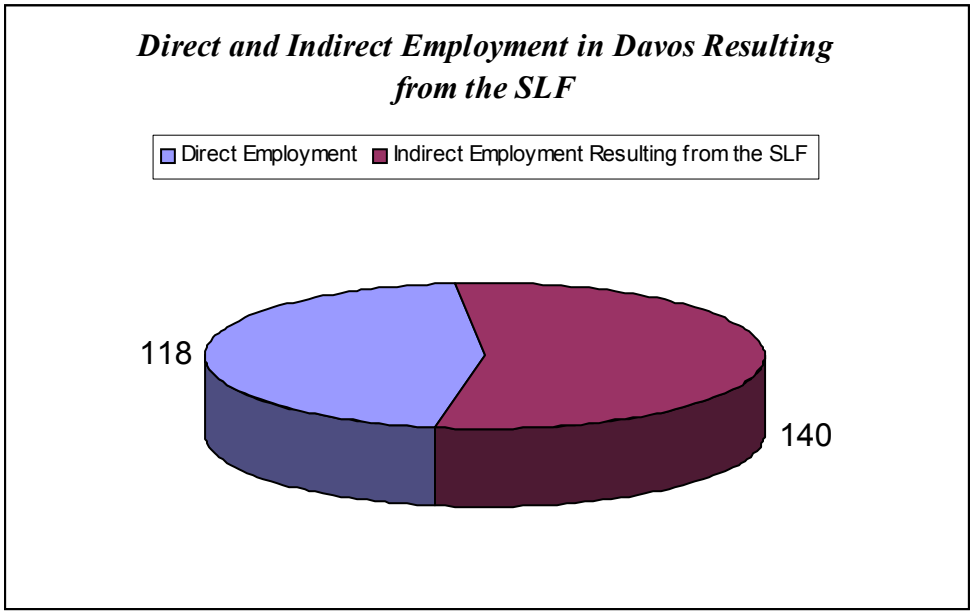


Figure 4.2.7 Direct and Indirect Employment in Davos Resulting from the SLF

Employee Wages

Not only does the SLF create a large number of jobs in Davos, it pays much better than the regional average. The average salary at the SLF in the year 2000, the latest year that data is available for the Canton, including graduate students, was CHF 72,000 per year. For Graubünden, the average salary was CHF 41,605. The average for all of Switzerland was CHF 46,620 (see Figure 4.2.8).

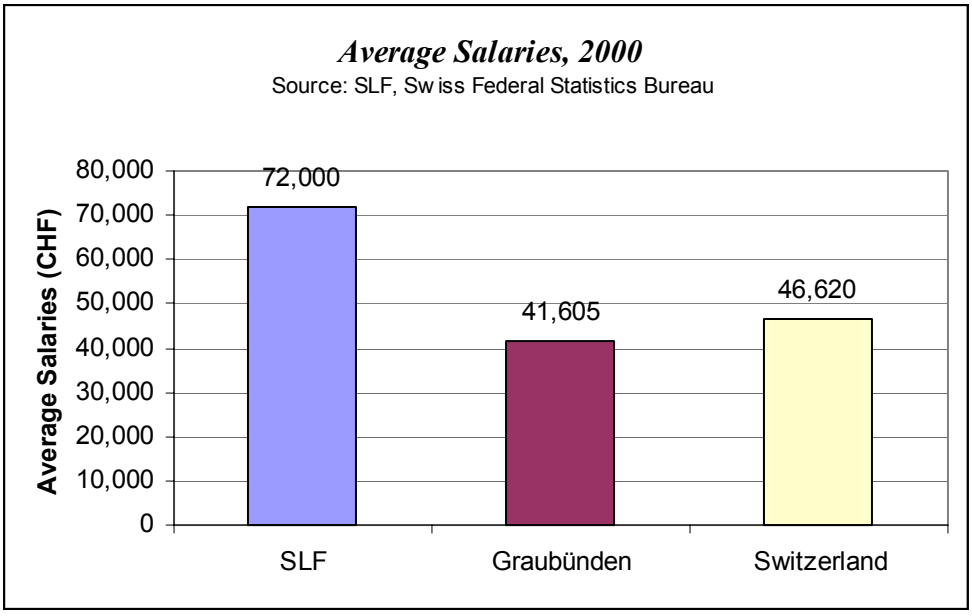


Figure 4.2.8 Average Salaries

As stated previously, 85% of the SLF's employees live in Davos. These higher salaries therefore benefit Davos. We examined average salaries for each of the five positions that we divided the employees into. We divided the wages paid out to location to determine that of the 10.37 million Swiss Francs paid out by the SLF in 2003, 82.3 percent of them went to employees that live in Davos (see figure 4.2.9).

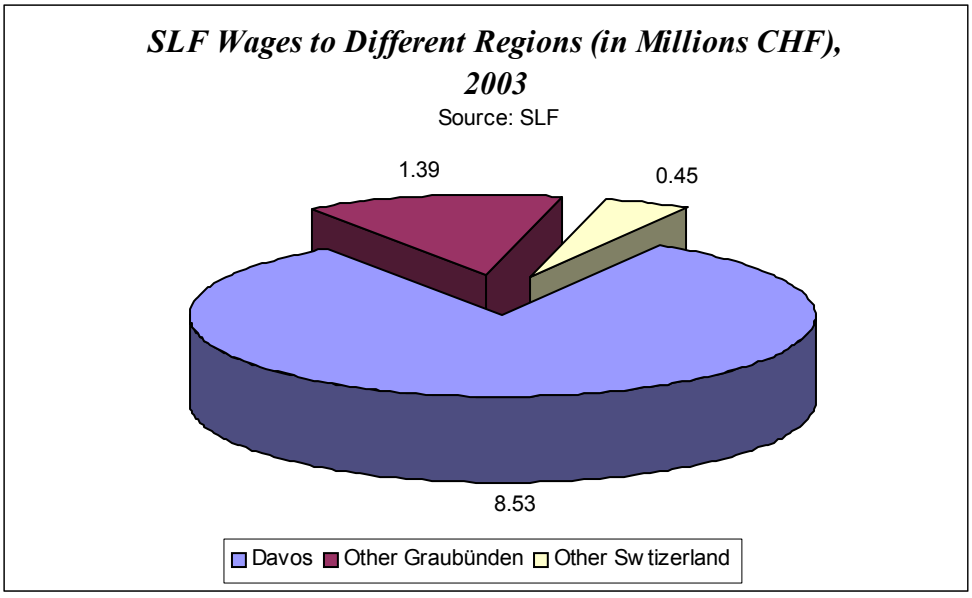


Figure 4.2.9 Wages to Each Region

As mentioned in Chapter 2, employment is one of the primary ways that money flows from an organization into an economy. The SLF employees affect their local and cantonal economy in two ways: the consumption of goods and services, and taxes paid to

the government. We will first show how their consumption and spending impacts the local economy.

Employee Consumption

Using the employee survey and economic tables on Davos from Wegmann, we estimated the consumption of the SLF's employees in Davos. On the survey, the SLF employees were broken down into nine different groups according to their job and home residence. The different job categories were simplified down to three groups to protect the privacy of the respondents. For home residence, one could choose either Davos, other Graubünden, or other Switzerland. We received approximately 50 percent of the surveys back for each of the categories. In total, we received surveys back from or 48.2 percent of the SLF's employees. On the survey, employees were asked how much they spent in various categories each month. Using this data, we estimate that the SLF's employees spent a total of 6.86 million Swiss Francs in 2003. Approximately 3.85 million of these Swiss Francs were spent within Davos (see Figure 4.2.10).

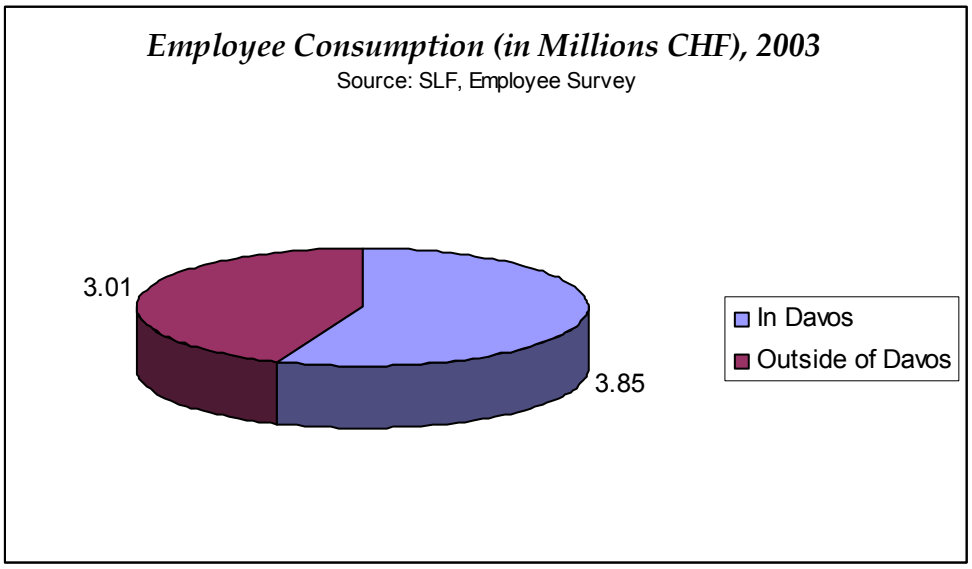


Figure 4.2.10 Employee Consumption

We demonstrated that the SLF is responsible for the impact of the employees by analyzing whether they would live in Davos if it were not for the SLF. The majority of the employees would not live in Davos if the SLF did not exist (see Figure 4.2.11). Therefore, Davos would not benefit from the impact they have on the economy. Besides the impact due to consumption, employees also contribute to government finances through the taxes they pay.

Figure 4.2.11 Would SLF employees live in Davos if the SLF did not exist?

Income Taxes

Knowing the distribution of where the SLF employees live, what their position is, average salaries for position, and income tax rates for Davos, Graubünden, and Switzerland, we were able to calculate the total taxes paid by the employees. We determined that approximately CHF 547,000 goes to the local government of Davos and CHF 672,000 goes to the canton of Graubünden. The total impact on government finances as a result of income taxes is CHF 1.61 million (see Figure 4.2.12). In addition to the employee spending contributing to the local and cantonal economy, we examined the spending of SLF guests that is another significant factor in the complete impact of the SLF.

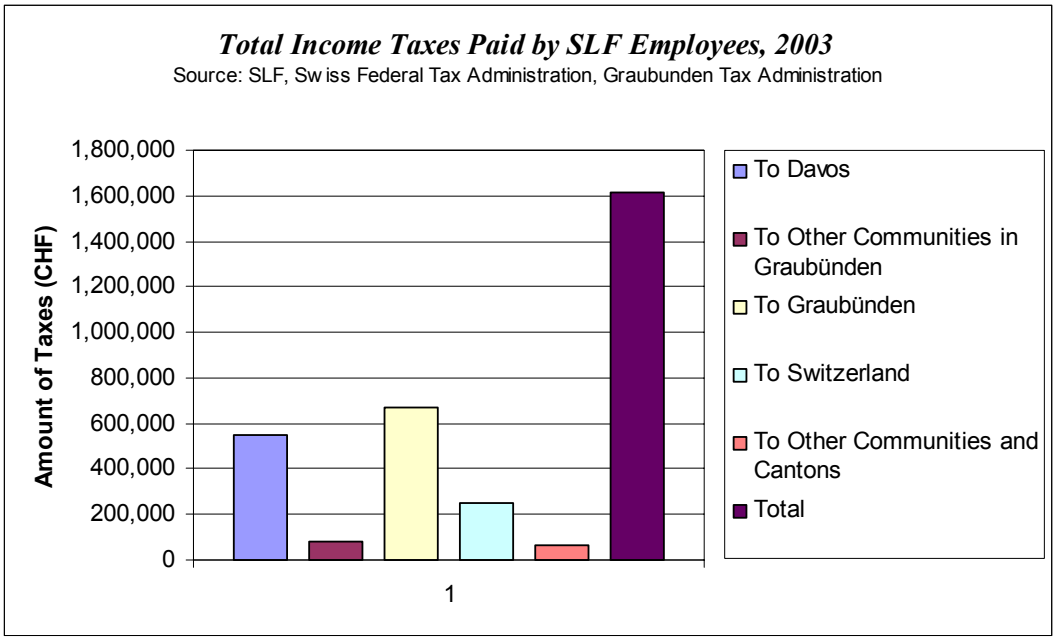


Figure 4.2.12: Income Tax paid by SLF Employees

4.2.3 The SLF's Expenditures

The SLF also contributes to the economy of Davos directly and indirectly through its expenditures. In 2002, the SLF's total expenditures on goods and services amounted to CHF 4.1 million (see Figure 4.2.13). The SLF spent CHF 608,000, 14.8 percent of its total expenditures, in Davos. It spent this money in industries such as food and beverages, hotels, transportation, real estate, and construction. These patterns do not represent an extraordinary year, but are representative of the SLF's average spending habits. In 2001, the SLF spent 17.6 percent of its total expenditures on goods and services in Davos. However, as was mentioned earlier, the SLF's budget has been steadily increasing recently. Therefore, its average expenditures from year to year have also increased.

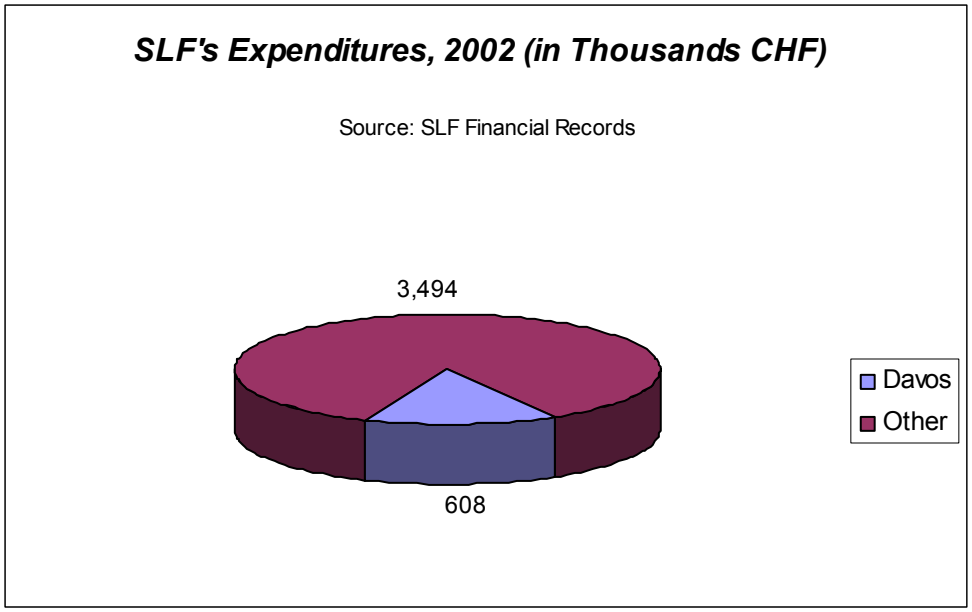


Figure 4.2.13 Location of SLF's Expenditures

Multiplier Effects

For every Swiss Franc that the SLF spends in Davos, it creates a larger impact than just the one Swiss Franc. This occurs when the local recipients of the SLF's expenditures re-spend some of this money in Davos. A ripple effect of the original purchase is felt through the economy over successive rounds of spending. This is known as indirect effects and is generally estimated using multiplier values. The information was unavailable for us to determine multiplier values specific for Davos. As a close approximation, we used the multiplier value for Upper Valais, which has an economy that is very similar to Davos. The multiplier determined for Upper Valais was 1.69. Using this multiplier, we estimate that the indirect effects from the SLF's expenditures are CHF 420,000. Summing the direct and indirect effects of the SLF's spending, we estimated that total impact of the SLF's spending in Davos was 1.03 million Swiss Francs in 2002.

4.2.4 The SLF's Guests

The SLF's guests come to Davos to attend conferences and workshops and spend money on hotels, meals, souvenirs, and entertainment. As stated in the methodology, we used three sources, employee interviews, the Valais report on Tourism, and our workshop survey, to quantify the amount of money that guests spend in Davos. We will first look at the individual results from each source and then how they were combined to yield the total spending for guests to the SLF's conferences.

AVAL-1D Workshop Survey

We surveyed guests that came to attend the AVAL-1D Workshop on November 13 and 14, 2003. Of the 27 attendees to the workshop, 19 filled out and returned the surveys (70.4 percent return rate). The results of the pertinent data from the survey are summarized in Table 4.2.1.

Table 4.2.1 Spending Habits of Attendees at the AVAL-1D Workshop

Average Hotel Price (1 Night, CHF)	Average CHF Spent on Food (1 Day)	Average CHF Spent on Other Expenditures (1 Day)	Average Daily Expenditures (CHF)	Average Nights in Hotel	Average Days in Davos
97.50	37.08	36	73.08	1.11	2.11

To obtain the amount spent on lodging, the average hotel price was multiplied by both the total number of guests and the average number of nights spent in a hotel. Attendees to this workshop spent a total of CHF 2,900 on hotels. It was assumed that days spent in Davos would be one more than the number of nights. To obtain the amount of money spent on daily expenditures, the average number of days was multiplied by both the average daily expenditures and the total number of guests. Overall, CHF 4,200 was spent on daily expenditures by the guests of the AVAL-1D Workshop. Summing the two values together, it was determined that guests of the workshop spent approximately CHF 7,100 in Davos.

This workshop is not representative of all workshops that the SLF hosts. The participants do not spend the same amount at every workshop. The number of guests, the days spent in Davos, and the season that the conference is held in all affect how much money the conference guests spend. For this reason, we looked at a report done by the Canton of Valais on how Tourism affects their economy so we could better estimate the spending habits of typical guests to the SLF conferences.

Tourism in Valais

As stated previously, how tourists spend their money in Davos and Upper Valais is very similar. The relevant information from the Valais Tourism study is summarized in Table 4.2.2.

Table 4.2.2 Spending of a Tourist in Upper Valais

Hotel		Average Spending	
Winter	**Summer**	**Overnight Guests**	**Day Guests**
CHF 203.00	CHF 192.00	CHF 128.00	CHF 74.00

The spending of guests of the SLF does not mimic the spending of tourists perfectly because for the majority of the day, the SLF guests will be involved in a conference. However, the spending of day guests in Upper Valais and the spending of the guests at the AVAL-1D workshop were nearly exact (CHF 73.08 versus CHF 74.00). For this reason, we will treat all of the SLF's guests as day guests while they are attending the conferences at the SLF.

The SLF recommends two hotels to its guests, Hotel Rössli and Turmhotel Victoria. The average prices, per person, at Hotel Rössli and Turmhotel Victoria are CHF 106 and CHF 178, respectively. Therefore, we believe that the estimates in Upper Valais are too high for guests to SLF conferences. We took the average of our survey, Hotel Rössli, and Turmhotel Victoria to determine the average amount spent per person on a hotel. We estimate the amount of money a guests spends per night to be CHF 128.

Employee Interviews

Table 4.2.3 SLF Conferences Held in Davos, 2003

SLF Conferences (2003)		
Conference Name	**Attendance**	**Length (Days)**
Advanced Course, Snow and Avalanches (German) – Dec.	54	3
Advanced Course, Snow and Avalanches (German) – Jan.	29	3
Ahorn	20	2
AVAL-1D Workshop	27	2
Cloudmap Meeting	26	3
Dis Alps Workshop	12	1
International Congress on Debris Flow Hazard Mitigation	200	3
International Symposium on Snow and Avalanches	175	5
IUFRO-Workshop	50	3
Rockfor	9	4
WSL-Birmensdorf Temporary Sheeting Conference	21	2
Total	623	31
Average	57	3

Before attempting to quantify the amount of money spent, it was important to determine how many people attended each conference and how many days each one lasted. Table 4.2.3 shows the number of guests that came to Davos for conferences sponsored by the SLF in 2003.

According to SLF employees, almost all of the conference guests stay in hotels during the duration of the conference. To account for people that live close enough to travel to the conference and not stay in a hotel, we estimated that 95 percent of the attendees stay in hotels based on employee interviews. To determine the nights stayed in hotels, we first took the number of days of conferences and subtracted one. However, employees who are involved with the conferences confirmed that many guests arrive either the day before a conference or stay a day later to avoid long days of travel or to spend time in Davos. This is particularly popular when conferences have unofficial icebreakers or have an excursion after the conference. Since our survey was held in the off-season, not many of the attendees to the AVAL-1D conference stayed after. Out of the returned surveys, 15.8 percent stayed two nights for the two-day conference. From interviewing the people at the SLF involved with running conferences, we believe that on average at least 25 to 35 percent of the guests stay at least one extra night. Based on talking to SLF employees and our workshop survey, we made a conservative estimate that 25 percent of the guests stay one extra night.

The Direct Impact of the SLF's Guests

Our estimates for the spending behavior of the SLF's guests, based on the three sources mentioned above, are summarized in Table 4.2.4.

Table 4.2.4 Behavior of SLF Guests in Davos

Average Hotel Price (CHF)	Average Daily Expenditures (CHF)	Average Nights In Hotel	Average Days in Davos
128	74	1.25*(Length*-1)	Nights in Hotel + 1
*Length Refers to the length of the conference from Table 4.2.3			

Using the same method that we used to determine the total amount spent at the AVAL-1D workshop, we determined the total spent on hotels was CHF 230,000 and that CHF 177,000 was spent on food and other expenditures. In total, guests to the SLF's conferences spent CHF 407,000 in 2003.

Multiplier Effects

For tourist spending in Davos, the multiplier was approximately 1.69. Guests to the SLF spend money in the same categories as tourists. Therefore, approximately CHF 280,000 was generated as a result of indirect effects of the SLF's guests. Summing this with the direct effects, the total impact of guests spending was estimated to be CHF 687,000.

4.2.5 The Total Impact

The total economic impact for one year cannot be found simply by adding the values already discussed, because data for both 2002 and 2003 was used. To estimate the total impact for one year, the direct expenditures data was extrapolated over 2000, 2001, and 2002 to estimate the spending of the SLF in 2003. Using this method, it is estimated that the SLF spent 4.52 million Swiss Francs on goods and services in 2003. Approximately 670,000 Swiss Francs, or 14.8 percent, was spent within Davos. Using the multiplier, this translates to an indirect effect of 462,000 Swiss Francs. When employment is included, however, over 61 percent of the SLF's budget goes to expenditures and employees in Davos.

In total, of the direct effects of the SLF, their expenditures, wages to employees, and direct spending of their guests summed to 15.3 million Swiss Francs. The total of the SLF's direct effects on the economy of Davos is 9.61 million Swiss Francs. The indirect effects, which include the indirect effects from the SLF's expenditures and guests as well as the consumption of the SLF's employees, in Davos were 5.14 million Swiss Francs. In total, the SLF was responsible for 14.74 million Swiss Francs to the economy of Davos in 2003 (see Figure 4.2.14).

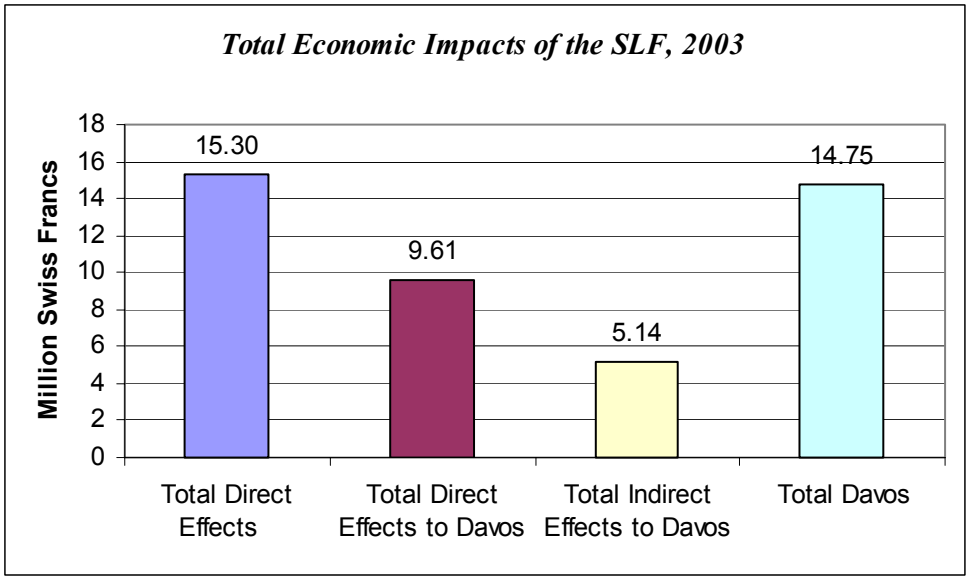


Figure 4.2.14 Total Economic Impact of the SLF in 2003

4.3 The SLF Provides a Range of Educational Benefits

The educational services and programs the SLF provides to the people of Davos and to Swiss universities are among the most prevalent of its contributions, to both Davos and Switzerland. Not only does the SLF strive to educate those students specializing in the field of avalanche research, but it offers many programs for the general public as well. The combination of these programs allows the SLF to educate a wide range or people, from the general public to doctoral students. In this section, we analyze the educational impact of the SLF, using data collected from the Swiss Federal Statistics Bureau, information about the SLF's work with universities, and interviews with the directors of the various educational programs held by the Institute.

4.3.1 The Impact of the SLF as an Institute of Higher Education

Swiss universities are funded with respect to the number of students enrolled from each of the 26 cantons. Each student's tuition is funded by his or her canton of origin, and not all cantons have a university. Figure 4.3.1 illustrates cantons with universities and their respective amounts of funding.

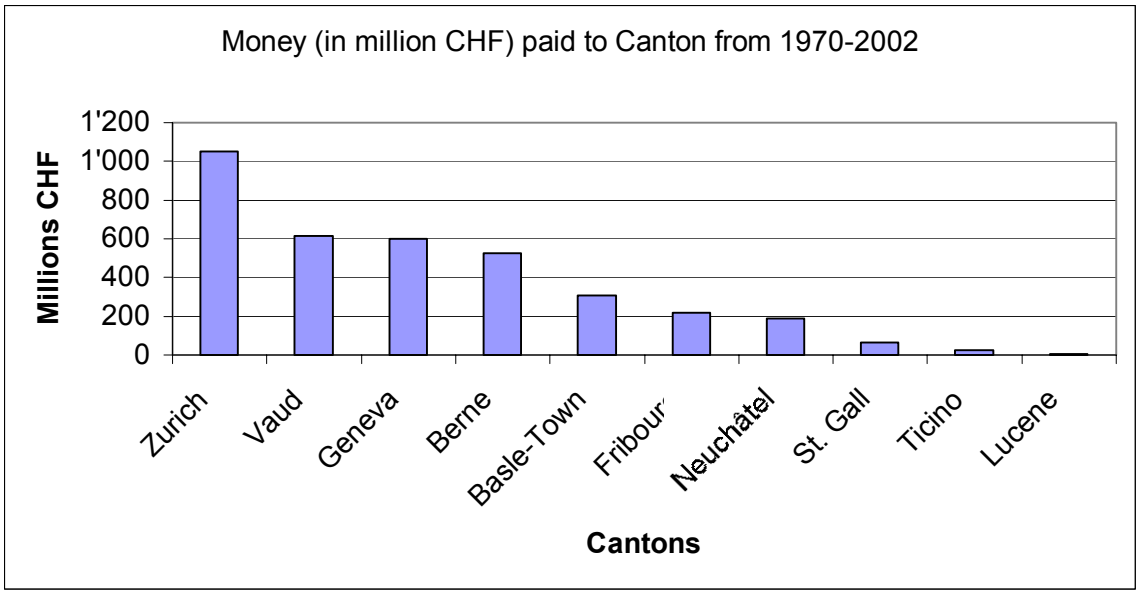


Figure 4.3.1: Money (in Million CHF) paid to Canton from 1970 – 2002

The SLF contributes to universities throughout Switzerland by providing students with in-depth experience in snow and avalanche research. In examining employee records, we found that there are currently 33 students working with the SLF. Each of these students is enrolled at one of the cantonal universities and as such, each student is funded at the cantonal level.

Undergraduate and Graduate Degree Programs

To find specific information regarding the educational finances for Graubünden canton, we contacted the Cantonal Office of Education of Graubünden. In the 2002-03 academic year, the Graubünden funded the education of 1400 university students and 541 graduate students. In total, CHF 20,900,000 was spent for university students and CHF 8,090,000 was spent for graduate students. The average annual costs per student were CHF 14,929 and CHF 14,953, respectively (Cantonal Office of Education, 2003). As illustrated in Figure 4.3.1, cantons throughout Switzerland receive funding that is proportional to the students they educate. There are currently 26 doctoral students and 7 diploma students working with the SLF. These students collectively represent CHF 493,299. Since Graubünden does not possess a stand-alone educational institution, it receives no reimbursement for higher education of any kind, including the courses offered at SLF for college credit and the doctoral research performed.

Students attending SLF's courses and making use of the Institute's facilities are enrolled at universities throughout Switzerland and in other countries, as well. Many students are affiliated with the ETH – Zurich, the leading technological university of

Switzerland. There are also a number of students from other cantonal universities, including University of Zurich, University of Basel, and University of Geneva. There are also three international students, from the countries of Argentina and Austria. Table 4.3.1 illustrates the range of universities represented by SLF's doctoral students, as well as their fields of study:

Table 4.3.1: Universities Represented by Students at SLF and Respective Fields of Study

Universities Represented by Students at SLF and Respective Fields of Study	
University	**Department**
BOKU Wien	n/a
ETH Zurich	Surface Science and Technology
ETH Zurich	Fluid Dynamics/Mechanical Engineering
ETH Zurich	Meteorology, Climatology, and Remote Sensing, Department of Geography
ETH Zurich	Atmospheric and Climate Sciences
ETH Zurich	Environmental Sciences, Terrestrial Ecology, Soil Physics
ETH Zurich	Atmospheric and Climate Sciences
ETH Zurich	Mountain Forest Ecology
ETH Zurich	Mountain Forest Ecology
ETH Zurich	Structural Analysis and Design
ETH Zurich	Mechanical Engineering
No current affiliation	Fluid Dynamics/Mechanical Engineering
No current affiliation	Mechanical Engineering
University of Basel	Mechanical Engineering
University of Basel	Meteorology, Climatology, and Remote Sensing, Department of Geography
University of Bath	Physics
Uni Genève	Science
University of Innsbruck, Austria	n/a
Universidad Bariloche, Argentina	Glaciology and Environmental Sciences
University of Innsbruck, Austria	Meteorology and Geophysics
University of Zurich	Geography
University of Zurich	Geography
University of Zurich	Geography
University of Zurich	Geography
University of Zurich	Geography, Geographic Information Systems
University of Zurich	Life Sciences

Research Projects as Scientific Developments

Though the financial aspect of the Institute's educational services is significant, there are additional characteristics that must be taken into consideration in evaluating the SLF's educational impact. The students working with the Institute are not merely receiving an education in their respective fields; they are taking active roles in

contributing new knowledge as well. To learn about the work of the university students, we researched their various projects. We studied their current project work and fields to see how they add to their sciences through the research they perform.

As mentioned earlier, 29 of the 36 students working at the Institute are performing research in pursuit of doctoral degrees. The projects they research are designated by their major interest and result in contributions that advance the field of avalanche technology, as well as other areas. The first step in evaluating the benefits of these students is to examine their work as it pertains to the field. The Institute's doctoral students are engaged in a variety of projects in a number of fields. In order to learn more about this research, we examined several of these students' projects and found them each promising in terms of the contributions they will make.

One student is working to assess the progression of avalanche risk in Switzerland over the past 50 years. Upon completion, this project will help the SLF to better identify problem areas and allow better management of resources to correct them. As the goal of the Institute is to prevent and reduce the danger of avalanches, this will be of significant value to the SLF's work.

The SLF also uses its existing technology for purposes other than snow and avalanche research. The automatic detection stations used for the Avalanche Bulletin detect snow depth in the winter, but can also be used to find the height of alpine vegetation in the summer. The SLF's Alpine Environment Research Department makes use of this technology, and it is also being used for graduate work. The student is currently investigating the growth of alpine vegetation and the factors that influence growth of alpine plants. This research will be useful in determining which regions are safe to build in and where the effects of construction would be detrimental to the environment. It is unlikely that this alpine research would have been funded without the Institute's existing detection stations. However, the SLF's innovative use of existing technology made this and other projects possible.

An Intellectual Draw for Davos and Graubünden

Brain drain is a significant threat to countries on every continent. When the educated portion of a population is forced to pursue employment outside of their local region, it results in a negative impact on the community. The International Monetary Fund conducted a study in 1999 with the intention of finding the extent of brain drain throughout the world.

In order to gauge the extent of brain drain in various countries, IMF monitored the migration statistics of developing countries to find the percentage leaving for the United States and to other Organization for Economic Co-Operation and Development (OECD) countries. The IMF study found that 7 million people immigrate to the United States each year, and a substantial number of these people have secondary or tertiary education in their country of origin. For example, India has seen more than 300,000 people migrate to the United States, and 75 percent of them had tertiary education in India. This loss of expertise is quite a significant impact throughout the world.

The SLF also has an indirect impact on the people of Graubünden as a result of its use as an educational institution. In order to find more information about these effects, we talked with Claudio Caratsch. Caratsch is a promoter of research and research policy for Graubünden. He is vice-president of Forum Engadin, a foundation for the support of education and cultural events in the Engadin Valley. He also operated a research facility during his years as a Swiss ambassador to the country of South Africa. During an interview with him, Caratsch informed us that the mountain areas of Switzerland (including the Davos region) spend approximately CHF 27 million annually for the education of students that do not return to their canton of origin after completing their studies. Among the mountain areas, Davos and Graubünden represent two areas particularly threatened by "brain drain." This threat is due to the lack of higher educational institutions within the canton. As there are no universities in Graubünden, any students wishing to pursue education beyond a collegiate level must do so in other cantons. The result of this process is the withdrawal of much of the intellectual component for Davos. The graduate students SLF brings to Davos help to work against this.

We discussed the concept of brain drain with the directors of PMOD/WRC and SIAF, as well. Dr. Werner Schmütz, head of PMOD/WRC, felt similar to Caratsch, and agreed that the research institutions of Davos pose the best response to the threat. Dr. Kurt Blaser of SIAF also agreed, and said that the doctoral students and researchers that the four research institutions draw to Davos are representative of the effort made against the pull of universities in other areas of Switzerland.

The expertise of SLF employees also helps against brain drain. The intellectual draw of the Institute benefits the local community in several ways. In the past ten years, SLF has increased their staff by 196% (see Figure 4.1.1). The research conducted attracts

students and researchers alike, and helps public knowledge as well. A greater number of SLF employees results in more expertise in a field especially practical to Davos – snow and avalanches. The Institute helps bring a practical intellectual group to the community through the research it conducts to make advances in its field.

The SLF provides several services to universities throughout Switzerland, from offering courses at other institutions and at SLF to hosting doctoral research projects. It also draws a number of people interested in higher education that would otherwise pursue regular cantonal universities. This results in a valuable contribution to the canton, in addition to possessing the traditional set of benefits associated with the expertise of a research institution.

4.3.2 The SLF Offers Educational Programs for the Public

The SLF hosts a range of services that more directly affect the community of Davos. It offers a variety of educational programs that contribute by educating local residents and anyone interested in snow and avalanche research.

Public Guidance

One program that serves to educate people about the research conducted by the Institute is Public Guidance. To learn more about this service, we attended one of the tours and consulted Birgit Ottmer. Ottmer directs several educational programs, and we were able to obtain attendance information in speaking with her. Public Guidance begins with a brief presentation of the SLF's mission and history, followed by a question and answer forum where participants (typically high school students) ask questions about the Institute. The tour then progresses to presentations of some of the recent and ongoing projects.

Each of these presentations lasts about 10 minutes and makes use of the various posters throughout the Institute in illustrating the research projects. There are also a few exhibits shown in the tour, such as a suit designed to protect against avalanche danger and one of the automatic detection stations used for the avalanche warning system. A different researcher makes a detailed presentation of his or her particular work to the tour group each week. In the course of the project presentations, the tour group is shown some of the facilities of the SLF including the climate control lab and the small-scale avalanche simulation building. The weekly audience can consist of as many as 40 people, and averages about 20 during the winter season.

The total attendance of these tours for 2003 at the time of our study was 2502. There were 2102 participants in the 112 special guided tours put on for universities, companies, and other groups. There were an additional 400 estimated people that attended the regular weekly tours. At the time of this study, there were 14 tours planned that had not been held yet. Of these, 7 were the regular weekly tours, and 7 were special guided tours. Among the special tours, 28 were from non-scholastic organizations, and 8 were from universities or comparable institutions. The remaining 76 tours were attended by other groups interested in the SLF's activities, including mountain guides, school teachers, sports clubs, and government organizations. Figure 4.3.2 illustrates attendance for the Public Guidance program over the past 4 years.

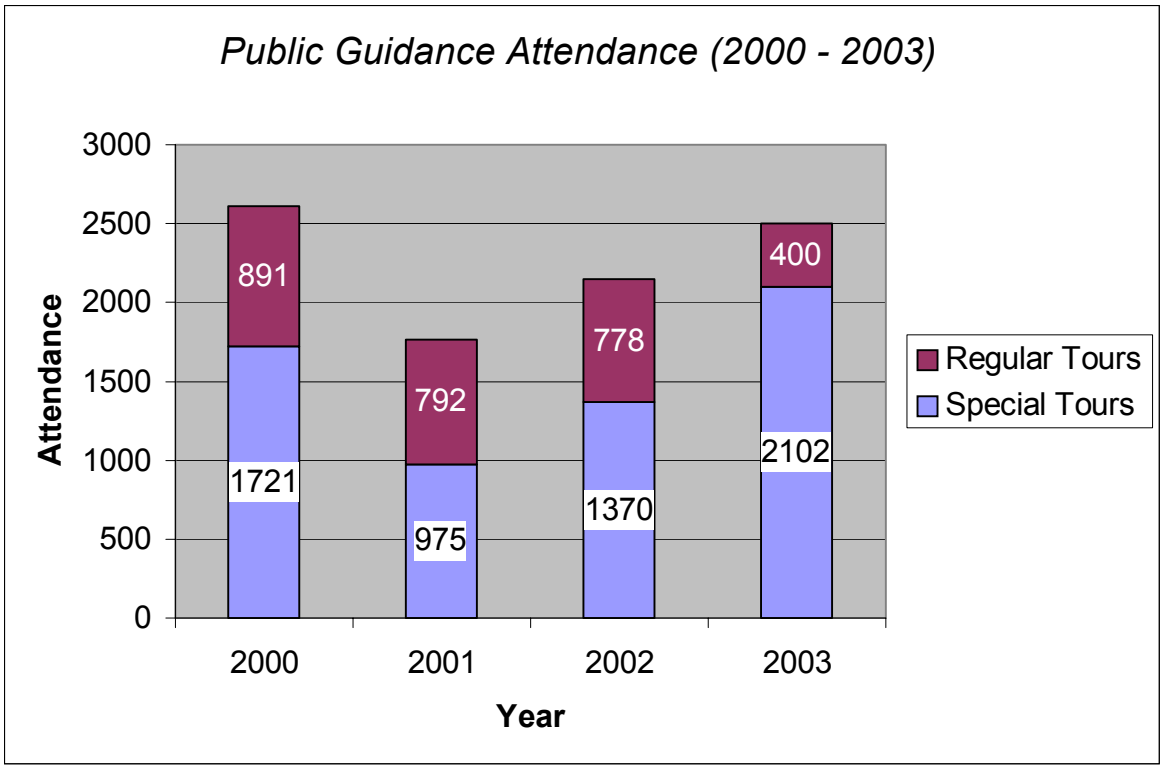


Figure 4.3.2: Public Guidance Attendance (2000-2003)

Day of the Open Door – Open House

The SLF also holds an Open House program called, "Day of the Open Door." Opening its doors to all people interested in avalanche research, the Institute is able to attract very diverse audiences, as anyone interested in the various kinds of research performed at SLF is encouraged to go to the Institute and learn more about it. The most recent Open House, held in 1996, had an approximate attendance of 5,000 people in the span of two days. At the time of this study, the January 2004 Open House was expected

to achieve a similar level of attendance. The SLF does a great deal to extend its knowledge to the community, and this is one example in which it does so.

Winter and Mountain Experience Paths

Two of the best attended programs hosted by the Institute are the Winter and Mountain (Summer) Experience Paths. We talked with Julia Wessels, the coordinator of these hiking trails, about the mission in putting them on and the success they have seen in their first two years. The two trails are maintained by the SLF, and guided walks are given each year. The goal of the programs is to educate the public about alpine environment and the effects of climate on vegetation and other life on the mountain.

In lieu of an in-depth presentation of the Institute's research, Wessels simplifies the developments made at SLF in order to stimulate public interest in research. She walks the participants through the research process and demonstrates some of the procedures performed to gain knowledge about the climate from trees, sources of water, and precipitation patterns. This presentation, in combination with the natural surroundings, helps to stimulate thoughts and questions regarding alpine environment that would not otherwise be addressed.

In the two years the paths have been hosted, the SLF collected various data in an effort to fine tune the program to the needs of the participants. For the Winter Experience Path, brochures were issued to participants at an average of one brochure for every two participants. As 15,000 brochures were issued, the annual attendance of the Winter Experience Path for the 2000-01 and 2001-02 seasons is estimated to be 30,000 participants. Estimated attendance for the Mountain Experience Path for 2001 and 2002 is 4,000 – 5,000. These figures were determined through the distribution of a postcard survey of participants.

The survey was administered to participants in an effort to gain feedback on what people enjoyed about the program. The data was then used to change the program to better suit its participants. One of the most frequent comments was that the trail served as a very informative and interesting program. Figure 4.3.3 shows the results of the 2002 survey, illustrating the 137 valid responses.

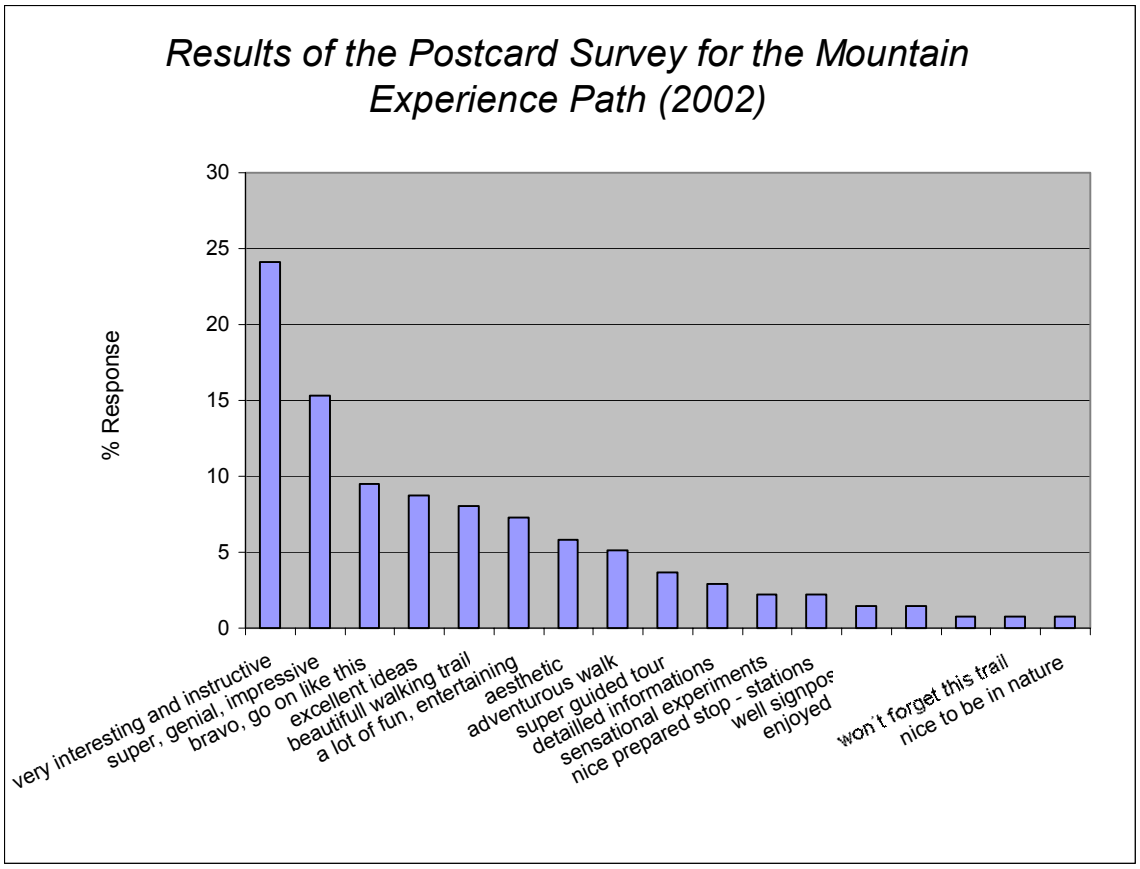


Figure 4.3.3: Results of the Postcard Survey for the Mountain Experience Path (2002)

Conferences and Symposia in Snow and Avalanche Research

The Institute also holds a variety of conferences and summits in its field. In 2003, the SLF hosted 12 conferences with a total attendance of 751 people. The topics of the conferences ranged from general courses to further knowledge in avalanche technology and research to specialized programs such as training for use of the SLF-developed AVAL-1D avalanche modeling program. These conferences provide a medium by which the Institute shares its findings with others in its field. Table 4.3.2 shows the various conferences attended by and hosted by the SLF during 2003 and the total attendance they received.

Table 4.3.2: SLF Conferences (2003)

SLF Conferences (2003)		
Conference Name	**Attendance**	**Length (Days)**
8th International Conference on Permafrost	300	5
Advanced Course, Snow and Avalanches (German) – Jan.	29	3
Advanced Course, Snow and Avalanches (French) – Dec.	28	3
Advanced Course, Snow and Avalanches (German) – Dec.	54	3
Ahorn	20	2
AVAL-1D Workshop	27	2
Cloudmap Meeting	26	3
Dis Alps Workshop	12	1
International Congress on Debris Flow Hazard Mitigation*	200	3
International Symposium on Snow and Avalanches	175	5
IUFRO-Workshop	50	3
Rockfor	9	4
WSL-Birmensdorf Temporary Sheeting Conference	21	2
Total	**951**	**39**
Average	**73.2**	**3**

*SLF participated in planning and logistics for the Debris Flow Congress, but was not the official host.

A key factor in evaluating the success of a program such as these SLF conferences is determining the views held by the participants. These participants come to the conferences to learn about the state of the art, and as such, they represent the best source for grading the conferences. We issued a survey to the participants of the AVAL-1D course to find their thoughts on the conference and on the SLF's conference in general. The results for this portion of the survey are shown in Table 4.3.3:

Table 4.3.3: AVAL-1D Workshop Survey – Conference Questions

AVAL-1D Workshop Survey – Conference Questions	
Survey Question	**Response**
1. How many times have you attended SLF Workshops/Conferences within the past 5 years? Include this one.	2.289
1a. Do you plan to attend more in the future?	18/19 (94.7%) yes
Key - 1. Strongly Disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree	
2. SLF is beneficial to Davos and the surrounding community.	4
3. I enjoyed this workshop.	4
4. I learned a lot at this workshop.	4
5. I would recommend this workshop to a colleague.	4

Many of the participants had been to an SLF-hosted conference before, and most had actually been to more than one. Participants agreed that the workshop was educational and engaging, and that they would recommend another SLF-hosted

conference to their colleagues. This shows that the conferences held by the SLF are valuable resources to those in the field of avalanche research. These conferences serve as a method of passing information among colleagues, and the people involved almost unanimously agree that the Institute has maintained a useful forum for doing just that.

The variety of symposia held in Davos by the Institute help the participants outside the SLF, but they serve to help the SLF gain knowledge as well. The International Symposium on Snow and Avalanches is one example of this valuable exchange of information. Although the conference was hosted by the SLF, it was held in conjunction with the Cambridge-based International Glaciological Society. The 175-member audience for this forum is proof of the magnitude of the contributions the Institute makes to the field of snow and avalanche research. The SLF also had some to benefit from the conference, sharing in the knowledge gained by others in their research.

Apprenticeships and Internships

In addition to offering educational programs for the general public, the SLF also helps individuals interested in a wide variety of careers. The Institute offers apprenticeships in several fields, including information technology and computer science. These apprenticeships help people throughout the local area and aid them in getting the certifications required for working independently. The SLF takes an active role in educating these apprentices in their chosen vocations, offering positions in each of these fields.

A Wide Range of Educational Programs for a Diverse Audience

The SLF provides a range of educational services to Davos and to Graubünden. It does so through a variety of programs designed to inform the public and to educate those interested in a variety of fields. Not only does the Institute use its resources for the study of snow and avalanches, it also uses them for alpine research and ecology studies, among others. The wide range of research conducted provides a valuable base from which doctoral students originating from around Switzerland come to conduct research in their specialized fields. The programs the SLF holds for the public and for its students are a significant contribution to the public, both locally and nationally.

4.4 The SLF Affects the People of Davos and Graubünden

The social portion of our impact analysis was structured to determine how the SLF affects Swiss residents directly. In characterizing this impact, we specifically examined the ways in which the Swiss benefit from the SLF. We also looked at the services they provide that directly affect the region's tourism. Lastly, we studied the various ways in which the SLF's research and services attempt to minimize avalanche accidents and damage, and the overall effectiveness of the methods chosen. Collectively, these data show the range of effects brought to Davos and Graubünden residents by the SLF's research and services.

4.4.1 The SLF Effectively Transfers Knowledge to the Public

The mission of the SLF is to study the characteristics of snow and snow cover as well as to study avalanche formation and protection. This research is also used by the Institute to understand the potential danger of avalanches. With this knowledge, the SLF informs the public of current avalanche conditions and of when caution should be taken. Since its founding, the Institute's primary goals have been to provide avalanche protection to areas at risk throughout Switzerland. There are two ways in which the Institute attempts to prevent avalanche accidents. The first is through knowledge in the field and the other is through technologies they put into practice throughout Switzerland. The combination of these methods allows for a comprehensive program that reaches people through both preventative and informative methods.

Prevention through Awareness

To extend their knowledge to the public, the SLF provides the widest avalanche warning service in the world - the Avalanche Warning Bulletin. To learn more about this valuable service, we spoke with Jakob Rhyner, the head of the Department of Avalanche Warning and Risk Management. He informed us that the principal objective of the bulletin is to keep the number of accidents and fatalities at a minimal level. He also indicated that there were two ways to save lives. The first of these methods is the prevention of avalanches whenever possible. As such, the SLF strives to prevent accidents from occurring in the first place. In cases where prevention is not an option, rescue is the necessary alternative. The SLF has networks in place with rescue facilities across Switzerland: a helicopter team can be at any point in the country within thirty

minutes' time. Prevention, however, remains the safest and most reliable method for reducing avalanche risk.

The SLF's service is only valuable if it is effectively communicated to the public. To do so, the SLF has instituted various methods of information transfer to make their avalanche bulletin easily accessible. Currently, they display avalanche danger over the Internet, Infobox, Fax on Demand, Automated Fax, and by telephone. Dr. Rhyner firmly believes that the SLF does a great job of reaching those interested in avalanche security. To suggest the increase in interest and accessibility, we compiled statistics pertaining to the number of the times the avalanche bulletin was accessed through each of the forms. This information was gathered from Manfred Steiniger of the SLF Avalanche Warning Service, which has recorded this information since 1996. The following graph (Fig 4.4.1) shows the number of total queries for the national avalanche bulletin throughout the past seven winters.

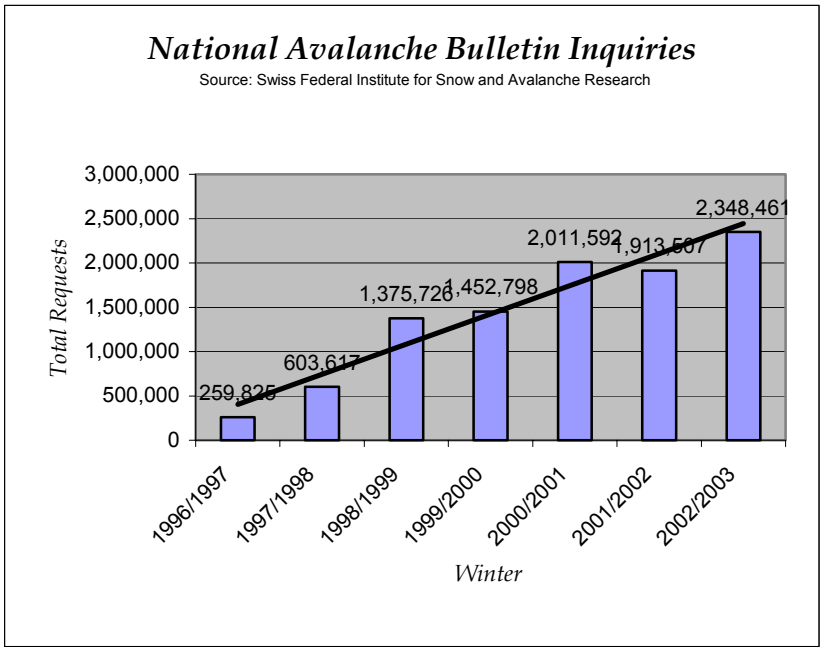


Figure 4.4.1 National Avalanche Bulletin Inquiries

The Avalanche Bulletin, a Reliable Source of Information

Over the past seven winters, there has been an increasing trend in the number of times the national avalanche bulletin is accessed in all languages. In the winter of 1996/1997 the bulletin was viewed a total of 259,825 times. However, the SLF saw a nine-fold increase in the winter of 2002/2003 with inquiries totaling 2,348,461 requests.

Also, the SLF issued an online survey[2] in 2002 asking about their services. Five hundred and nine people responded to the survey (56 women and 453 men) with an average age of 34.4 years. The people surveyed were asked how content they were with the SLF's national bulletin. On a scale from 1-7 with 7 meaning very content, the average score was 6.08. They have had an impact on the community in such a way that makes them interested in the bulletin and eager to benefit from the services.

4.4.2 The SLF Attempts to Minimize Avalanche Accidents

The other way the SLF attempts to prevent avalanches is through their hard technologies they possess such as snow fences, automatic detections stations, and artificial triggering of avalanches. To gauge the effectiveness of the SLF's programs, we studied the various preventative measures and the results of their implementation in recent years.

Reducing Avalanche Risk

Our first step toward understanding the impact of the Institute's preventative measures was to interview Stefan Margreth, a SLF employee in the department of Snow and Avalanche Research. He informed us that that in the winter of 1998-1999 there were over 300 avalanches prevented from causing damage and deaths. This includes areas that were evacuated to prevent disaster. The SLF brochure claims that the 1998-1999 season left 17 fatalities and a loss of over CHF 600 million in its wake. Stefan Margreth continued to say that without avalanche protection measures, the damage would have been far worse.

Have the SLF's avalanche prevention methods proved successful over the years? To answer this question, one must first realize that no direct correlation between SLF's research and a change in avalanche fatalities and damage can be made. However, it can be agreed that they strive to protect the public and that statistics show a declining trend in deaths and damages. For example, the number of avalanche deaths has not dramatically decreased over time, however, population and tourism has increased. Figure 4.4.2 graphs the average population and the total avalanche deaths per decade. Each column on the graph represents the number of avalanche deaths per one million Swiss residents over a ten year time period.

[2] This is the same questionnaire described before. Refer to footnote 1 to view the limitations of the survey.

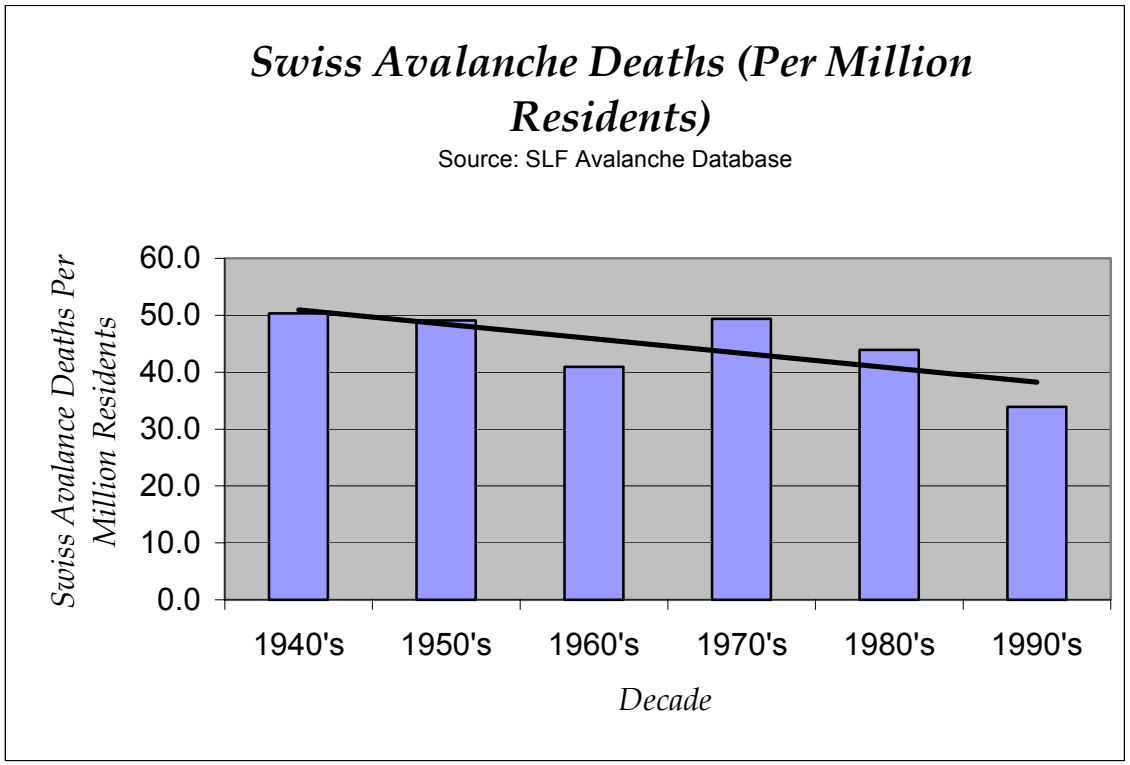


Figure 4.4.2 Swiss Avalanche Deaths (Per Million Residents)

Figure 4.4.2 has been normalized to compare two changing trends. The trend is decreasing over time, which indicates SLF's research has had a social impact on the public. Whether the SLF's research is responsible for the majority of the decline is indeterminable by our means of research. Also, we understand tourism has had a large impact on Switzerland. Ideally, we would like to include how the number of people exposed to avalanches, both residents and tourists, have increased over time. Yet, due to limitations in our study, we were not able to find accurate data pertaining to tourism in Switzerland.

Reduction of High-Risk Areas

We were, however, able to obtain data for high-risk areas of Switzerland and the nature of avalanche-related deaths. During the last 66 years, each Swiss avalanche fatality was categorized into the location where it occurred: in backcountry, buildings, or on roads. Backcountry refers to unmonitored areas of land, which may prove to be dangerous. People who choose to engage in outdoor activities in these regions knowingly expose themselves to avalanche danger. Fifty years ago, the majority of the avalanche fatalities occurred in buildings and on roads. However, as avalanche prevention and protection improved over time, virtually no deaths happened in homes or on roads.

Figure 4.4.3 breaks down the total number of deaths per year and the category to which each belonged, as described above:

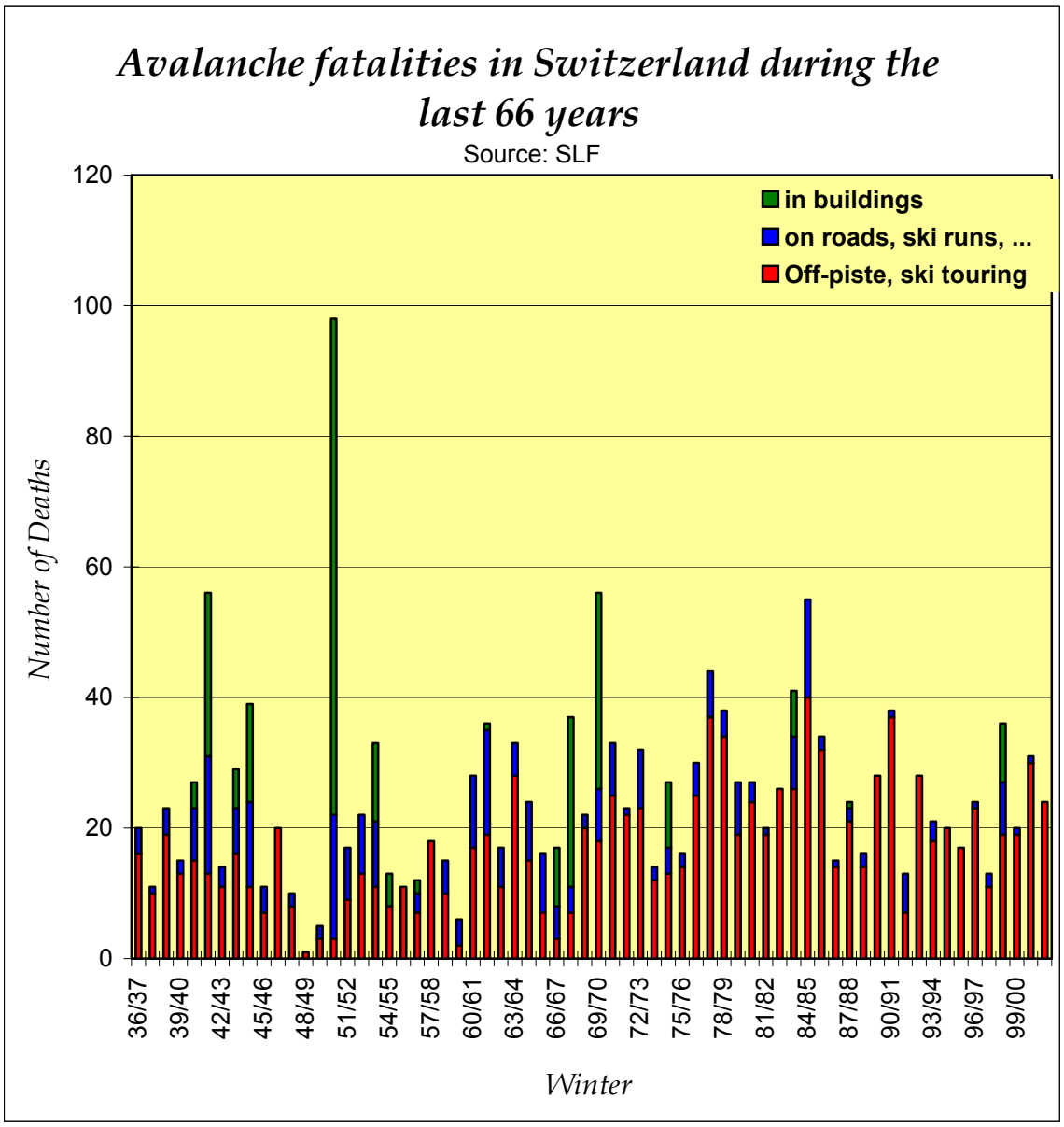


Figure 4.4.3 Avalanche Fatalities in Switzerland during the last 66 Years

The following graphs illustrate the percentage of total avalanche deaths in each category per decade. The decrease in total death percentage in buildings and on roads suggests there is an efficient flow of information from the SLF to the public. Proper evacuation procedures are being taken as a result of avalanche knowledge.

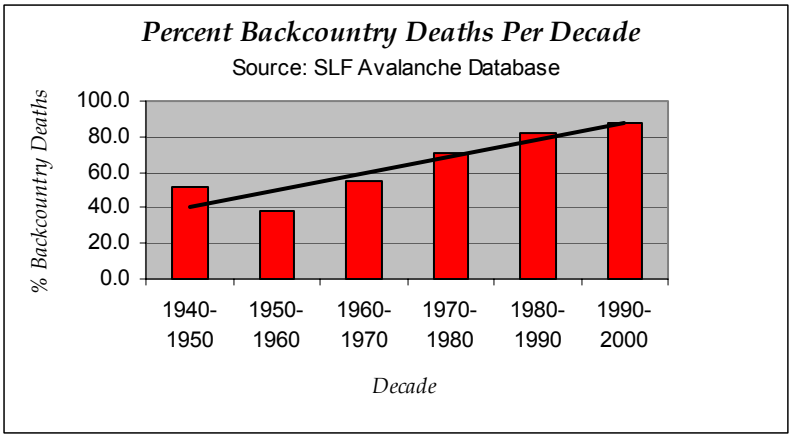


Figure 4.4.4 Percent Backcountry Deaths Per Decade

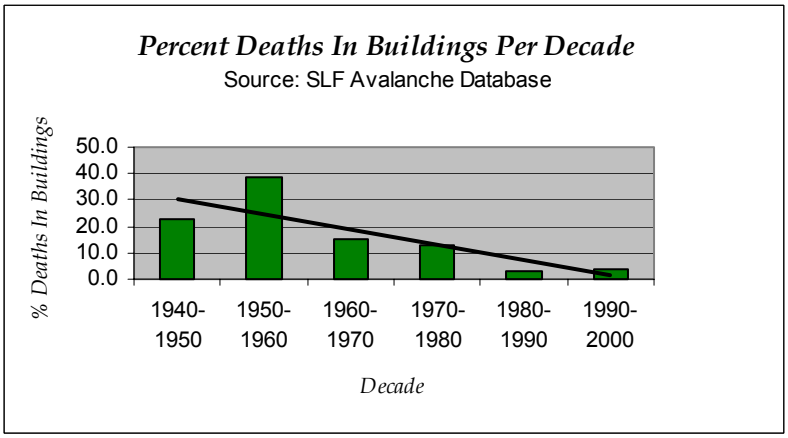


Figure 4.4.5 Percent Deaths In Buildings Per Decade

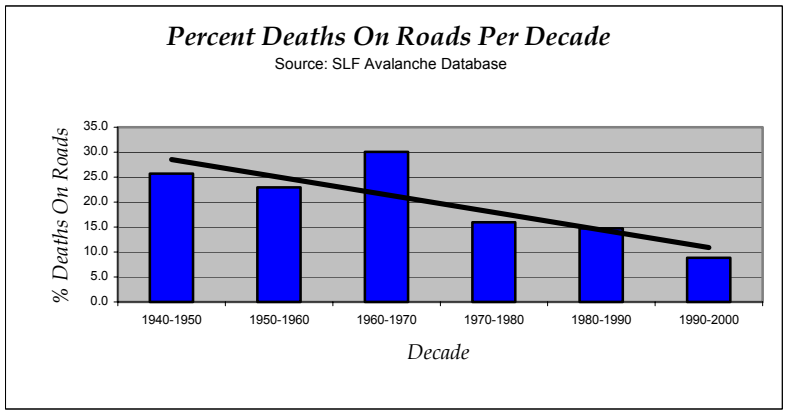


Figure 4.4.6 Percent Deaths On Roads Per Decade

Dr. Jakob Rhyner explained a fatality in a home or on a road today would be considered a severe disaster. Clearly, these statistics have been minimized over the years reflected in the previous graphs. .

The SLF is an organization that provides services in an effort to protect the public from avalanche hazards. The data discussed above shows that they have minimized

avalanche accidents over time. The Institute's knowledge and hard technologies have affected the community exposed to avalanches.

4.4.3 The SLF Contributes to Preventing Avalanche Damage in CHF

Avalanches are destructive natural disasters that have caused large amounts of monetary damage in the past. Therefore, the SLF's avalanche warning and prevention has become exceptional useful in decreasing monetary loss. We have received data from the Swiss Statistical Office for the estimated cost of Swiss avalanches from 1977 – 1999. The following graph (Figure 4.4.7) shows the estimated cost of avalanches in Switzerland measured in Swiss francs from 1977-1998[3].

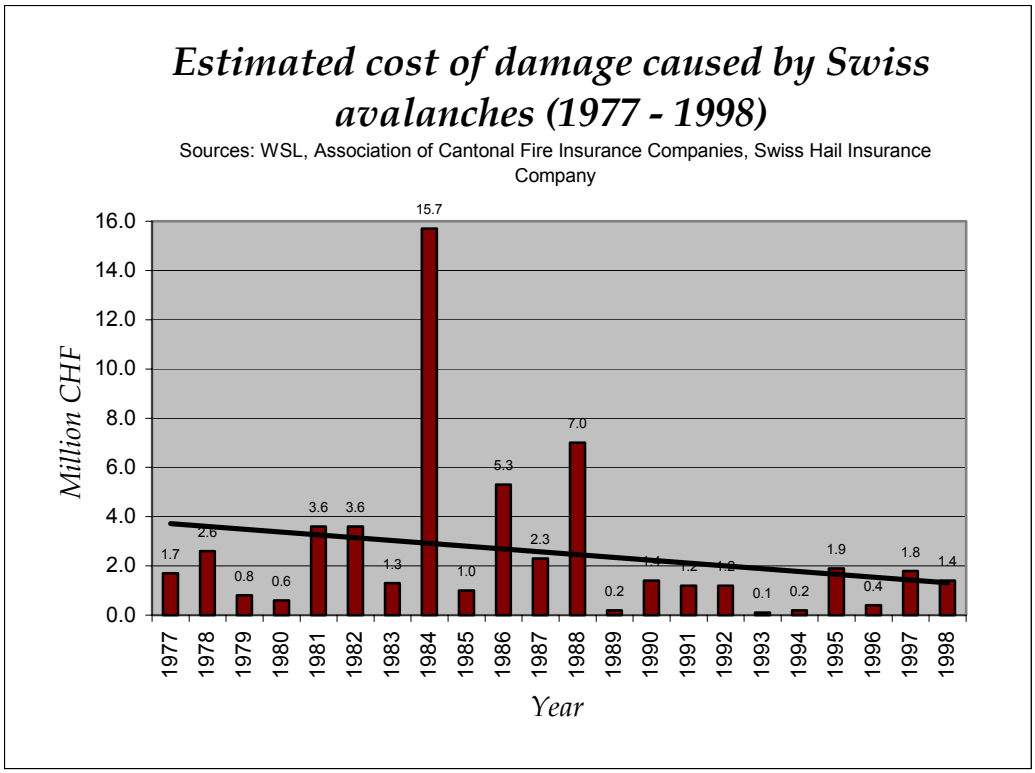


Figure 4.4.7 Estimated cost of damage caused by Swiss avalanches (1977-1998)

The damage cost (in CHF) has declined over the years with the winter of '99 being an outlier.

Fatalities and monetary loss have substantial social implications on a community. Avalanches are responsible for both. Therefore, the SLF's research and knowledge is

[3] For analysis purposes, we left out the monetary damages from the winter of 1998/1999. We believe that this year was an extraordinary year and the damage would have been larger if it was not for the prevention methods.

especially important in preventing accidents from occurring in the first place. Agreeing with the data above, the SLF has been successful in providing avalanche protection to the community.

The SLF's goals include preventing and warning people of dangerous avalanches. An increase in the use of the avalanche warning service and decreasing trends of deaths in populated areas and damages lead one to infer that the SLF has been successful in these areas.

5. Conclusions and Recommendations

The Swiss Federal Institute for Snow and Avalanche Research has a profound impact upon the people of Davos and Graubünden. Throughout this report, we have documented the process and results of analyzing this impact from a variety of perspectives. In the *Literature Review*, we discussed relevant background knowledge necessary in considering such a study. In the *Methodology* section, we explained our procedures in finding the information required for our analysis. In *Data Analysis and Results*, we showed the results of our research and explained some of their consequences. This chapter will draw primarily on the previous one, discussing the implications of our impact analysis.

5.1 Recognition

Table 5.1.1: Recognition Conclusion / Data

Recognition Data / Conclusions
Key Findings:
Inquiries for National Avalanche Bulletin has increased over 900% since 1996/1997
From 1996-2003, the Internet has increased from 25% of the total avalanche bulletin inquiries to 89%
In 2002 and 2003, the SLF's name appeared in over 22.6 million published articles
In an online survey, 84% of the people stated they visit the SLF homepage regularly
The Institute appears daily on DRS-1 and biweekly on DRS3, two national radio stations
Newspapers run the bulletin often to display avalanche danger decided by the SLF
Conclusions:
The SLF is successful in reaching their audience: the community
SLF's name is extremely prevalent in the media
The SLF webpage receives regular visitors
The SLF is important to the public

The name recognition the SLF generates is a key factor in showing the community as an international research center. The Institute brings prestige to the region in several ways. Its peers have established it as the international leader in snow and avalanche research, and it also provides an internationally known service in the form of the Avalanche Bulletin. Additionally, the SLF has a large media presence through the bulletin and through its research.

In 2001, a study concluded that the SLF is the world leader in snow and avalanche research. This study was conducted by a group researchers in fields related to that of the SLF, and accurately shows the Institute's position in the field. The SLF also brings prestige to Davos through its frequent journal publications. Averaging 52 reviewed articles per year, the Institute is among the top in its field. It retains a position of leadership in the field of snow and avalanche research through publishing new work and staying current with new and emerging technology. The SLF also generates recognition among its peers through the funding it receives from grants. In 2002, the Institute received over CHF 2 million in grants from government and educational agencies.

The SLF also hosts the Avalanche Warning System, which serves all of Switzerland. Communication networks are in place with transportation systems through local, cantonal, and federal authorities to ensure quick response time to changes in avalanche risk. The Swiss people use the Avalanche Bulletin regularly, as it is accessed over 2.3 million times per year through a variety of methods, and is referenced and cited in weather reports across the nation every day.

The SLF has a large media presence. In a study of the amount of space the SLF receives in print media, it was found that over CHF 11 million would be spent to advertise on the level the SLF achieves through avalanche warning and research each year. This value serves to quantify the amount of attention the SLF receives from print media alone. It does not include the numerous daily television announcements of the avalanche bulletin, nor does it consider the daily and biweekly radio appearances made by the Institute throughout the winter season. The combined impact of the attention granted SLF on each of these media serves as a measure of the attention Davos receives as a result. As such a distinguished research institution, the SLF is able to provide many benefits to the community of Davos and Graubünden.

Recommendations

The SLF brings a great amount of prestige to the surrounding region. Although it has a sizeable presence as a leader in its field, we believe that measures could be taken to improve upon its position. We recognize that the Institute is a well-published organization, but improving its status in this area would greatly affect the amount of attention Davos receives as a center of research. If the SLF increases its peer-reviewed journal publications, it would result in more positive recognition.

5.2 Economic

Table 5.2.1 Economic Conclusions / Data

Economic Data / Conclusions
Key Findings:
The Majority, over 99%, of the SLF's funding comes from outside the Canton
For every Swiss Franc of revenue that comes from inside the Canton, the SLF spends 101 Swiss Francs on expenditures and wages in the Canton
17.6 percent of the SLF's direct expenditures are spent in Davos
The SLF's direct and indirect effects of the SLF's expenditures total 1.03 million Swiss Francs in Davos
85% of the SLF's 139 employees live in Davos
The SLF's employment is responsible for supporting 140 jobs in Davos indirectly
The SLF pays out 8.53 million Swiss Francs in Wages to Davos
The SLF's employees spend 3.85 million Swiss Francs in Davos
The SLF's employees contribute 1.61 million Swiss Francs to the tax base
The SLF's guests contribute 687,000 Swiss Francs to the Davos economy, directly and indirectly
The SLF's total direct contribution to the economy of Davos is CHF 9.61 million annually
The SLF's total indirect contribution to the economy of Davos is CHF 5.14 million annually
Conclusions:
The SLF provides an inflow of money to Davos in several ways
The SLF's impact on Davos has grown greatly in the past 10 years due to an increase in Third Party Funding
Research and Development are an important part of the economy in Davos
Employees spend most of their wages in the Davos area
SLF's expenditures and guests contribute to the Davos economy
The SLF employees contribute to the tax base of Davos and the Canton

One way in which the SLF has an influence on the local region is through its significant economic contribution to the area. The Institute brings a great deal of resources into Graubünden, as the vast majority of its funding is derived from outside the canton. The SLF also provides employment for a substantial number of people, and is

primarily responsible for their spending in Davos. The combined effects of the SLF's direct investments in Davos and of the wages paid to SLF employees have a profound effect on the economy of Davos and on that of Graubünden.

The Institute provides an inflow of resources to the local region in several ways. As the organization receives a minimal amount of cantonal funding, its finances originate from outside the canton. This funding is achieved through a combination of federal funding and third party financing for individual projects. Worth noting, this third party funding has increased greatly over the past 10 years, resulting in an expansion of the SLF in terms of employees and in research areas.

Research and development are an invaluable sector of Davos' economy, as the SLF and the other research institutions in Davos help to provide a highly educated group of residents. These residents help the economy of Davos in several ways. The average wage at the Institute is much higher than that of Switzerland and Graubünden. In our survey of SLF employees, it was found that the majority of wages paid by SLF are spent in Davos. Collectively, these employees represent a significant tax base for Graubünden. The survey also showed that the majority of employees would not be interested in remaining in Davos, were the SLF not providing them with employment.

Other ways in which the Institute contributes to the local economy are through its direct expenditures and through the conferences it hosts in Davos. Over 15% of the SLF's direct expenditures, almost all of which originates from outside the Canton, is spent within Davos. This represents a significant return on the relatively small investment given by Graubünden.

Throughout our study, we made use of various statistics and previous studies. However, there were some areas in which there was no reliable data. This situation presents a some limitations to our study. The indirect effects of SLF spending are rough estimates, as there is no reliable input-output table for the country of Switzerland or Graubünden Canton. As such, we used an economic base model and a study on tourism done in Valais to aid in determining this important contribution. These models are reasonable approximations, since the economy of Davos is very similar to that of Upper Valais, but do not result in the best possible estimates. Also, the data we used as a base for our study was a mix between the years 2002 and 2003, as there were gaps in knowledge for both years. We confirmed that these years were not extraordinary through a comparison with other recent years, and they were chosen because the most recent and

most comprehensive data was available for them. We compiled the information, but that all of the data is not consistently for the same year, there may be slight misrepresentations of data. We do not believe, however, that either of these limitations had a major effect on the reliability of our analysis. They must, however, be taken into consideration.

We were able evaluate the SLF's economic contribution to Davos and the surrounding region accurately; given the information and resources we had access to. The SLF provides a great influx of finances into the town of Davos and to the Canton of Graubünden.

Recommendations

The SLF makes a significant contribution to the economy of Davos and to that of Graubünden. During our analysis of this contribution, our primary limitation was a lack of concrete data for the SLF's expenditures. We were able to obtain comprehensive data through compilation of data from several sources, but it would expedite further economic evaluations if one source were able to maintain a regularly updated, comprehensive, and easily accessible database of Institute resources, expenditures, and employee records. Such a database would allow data collection minimizing approximation and compilation from differing sources.

5.3 Educational

Table 5.3.1: Education Conclusions / Data

Educational Data / Conclusions
Key Data:
The SLF hosts doctoral programs for Ph.D. students and undergraduate programs for diploma students without compensation from cantonal or federal government
Thousands of people use the SLF's educational services each year to learn more about avalanche and alpine research
Conclusions:
The SLF provides educational services to a number of Universities
The SLF holds programs to increase public knowledge of snow and avalanche research
The SLF holds internationally respected and attended conferences each year

In addition to its significant economic effects, the SLF provides an array of educational benefits to Davos and Graubünden. It offers the expertise and experience of

its staff to universities throughout Switzerland and abroad through taking on graduate and undergraduate students. The Institute also uses this expertise to increase awareness of avalanche danger and knowledge in avalanche research in the community of Davos. Additionally, the SLF hosts a number of conferences each year to exchange the knowledge they gain through their research with the Institute's colleagues around the world. This combination of services results in a total contribution affecting a wide range of people, from high school students and tourists to graduate students and research colleagues.

The doctoral and undergraduate programs and courses of study offered by the SLF have a direct effect on the universities in Switzerland. The resources students are allowed to use at the SLF would not be accessible at universities, and so the hands-on experience they gain at the Institute would otherwise be limited. Students and researchers alike are able to use the SLF's equipment for alternate research areas as well, such as alpine environment studies. The Institute allows the use of its facilities for educational purposes for undergraduate and graduate students pursuing a variety of fields. However, as Graubünden does not have any stand-alone universities, neither the SLF nor Graubünden are compensated for these services.

The SLF also allocates resources toward educating people that aren't specializing in snow and avalanche research, but that show interest in the field. They do this through a range of programs, each catering to a different audience and communicating different information. The Public Guidance tours and Mountain and Winter Experience Paths bring thousands of people each year interested in the SLF's work and educate them as to the research performed at the Institute. Through these forums, the SLF is able to educate the public as to avalanche risk and research.

The Institute also hosts a number of conferences each year. These conferences serve as a means of exchanging information among colleagues, and result in furthering the science of snow and avalanche technology. That the SLF host these conferences and makes significant contributions in each of them is proof of the Institute's value in the field. Conference participants have found workshops valuable and informative. The various conferences and symposia held by the Institute show the SLF as a leader in its field while exchanging information with professional colleagues. The combination of the Institute's educational services results in a comprehensive educational program, affecting a wide range of people, from high-school students to doctoral students.

Recommendations

The SLF provides a great amount of resources toward higher education in Switzerland. It would be valuable to the Institute to pursue compensation for the students that work there. Their cantonal governments pay for their tuition, but during their graduate studies, the majority of their work is performed at SLF. Funding these students would allow the SLF to improve upon its educational programs considerably. Although the Institute has recognized this, we recommend that the SLF devote its applicable resources to investigating the possibilities of cantonal funding. This avenue of funding would have a beneficial effect on the SLF through the capability to perform further research, and it would positively affect the Canton as a center for higher education.

5.4 Social

Table 5.4.1: Social Conclusions / Data

Social Conclusions / Data
Conclusions:
The SLF protects the community through avalanche warning
The SLF contributes to saving people's lives
The SLF minimizes avalanche damage
Key Data:
On a scale from 1-7 (7 meaning very content), people scored their feelings on the bulletin as a 6.08
Swiss Avalanche Deaths (Per Million Residents) have decreased since 1940
Percent backcountry deaths have increased, while in buildings and on roads have decreased since 1940
Estimated cost of damage caused by Swiss avalanches (1977-1998) has declined

The SLF affects a great deal of people through its educational program, but it also offers services designed specifically to aid the public. In determining the social impact of an organization, however, one must take more of a qualitative approach. There are no definitive numbers to help quantify the influence. Therefore, examining the SLF's services and determining its affect on the public was the basis of the social impact portion of our analysis.

The SLF protects the community through avalanche warning. The Avalanche Warning Bulletin is one of the SLF's most distinguished services. The purpose of it is to inform the public about potentially dangerous avalanche locations. This has proved to be beneficial to the community. On a scale from 1 to 7, with 7 meaning very content, people rated their feelings on the bulletin as a 6.08 on average. This figure was derived from an online survey distributed by the SLF. Also, Swiss avalanche deaths (per million residents) have decreased since 1940. After taking these statistics into consideration, we conclude the SLF contributes to saving people's lives. Due to limitations in our study, we cannot conclude that the SLF directly saves lives, but their research and services attempt to minimize avalanche accidents. There are many factors that could be responsible for this decreasing trend such as lack of snowfall/avalanches, a more knowledgeable population, or other avalanche prevention services. There is no method to quantify the exact input the SLF is accountable for in preventing avalanche deaths.

Also, the SLF is partly responsible for a decrease in monetary losses as a result of avalanche damage. The limitations discussed above apply to this point as well; the Institute cannot be held solely responsible for reductions in avalanche damage. However, the SLF's efforts are, in part, the cause of these reductions. According to Figure 4.3.7, avalanche damage (in CHF) has decreased from 1977 until 1998.

Other limitations we experienced pertaining to this section of our impact analysis were primarily due to a lack of current information. We were not able to obtain monetary avalanche data beyond the year of 1999. Also, we were very interested in determining how Swiss avalanche deaths with respect to the population at risk have changed over time. Instead of solely taking Swiss population into consideration we planned to examine how tourism in mountain areas has progressed. However, this information was not available. Though there were some limitations during our study, we have achieved good data that accurately reflects the impact of the SLF's work, as it affects the people in the local region as well as those from throughout Switzerland.

Recommendations

The SLF provides a beneficial social impact to the community. However, there is still an area of its social contributions that could improve through further investigation. The SLF provides a valuable service through the Avalanche Bulletin. Unfortunately, capabilities are limited, as it is not satisfactorily conveyed to those most at risk. The SLF

performs very well in reaching the majority of the population. One sector, however, poses a significant problem in effectively communicating the Bulletin to its target audience. Teenagers make up a large percentage of people who participate in winter sports such as skiing, snowboarding, and hiking. Their need for avalanche knowledge is vital, but their interest in the Avalanche Warning Service is lacking. The SLF could increase awareness to this age group by appearing in public schools. Possible methods for encouraging interest in the Bulletin include providing seminars relating to how avalanches are initiated and various procedures that could be taken to protect oneself. The earlier the age at which a child is exposed to avalanche protection information, the more apt he or she will be to respect the danger. In addition, this introduction might spark an interest in science and research, which could in turn benefit the community.

5.5 Summary

The SLF provides a range of benefits to the community of Davos and Graubünden through the various services it provides. In this study, we analyzed these services, and concluded that the Institute's contribution is quite substantial in each of the four categories we established. As the world-leader in its field, the SLF uses a variety of methods to provide a great deal of contributions on local, national, and international levels.

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Appendix A: AVAL-1D Usergroup Workshop Umfrage

AVAL-1D Usergroup Workshop Umfrage

Sehr geehrte Damen und Herren,

herzlichen Dank für Ihr Mitmachen an einer Studie die gemeinsam vom Eidg. Institut für Schnee- und Lawinenforschung SLF Davos und Studierenden des Worcester Polytechnic Institute, Boston (USA) durchgeführt wird. Ziel der vorliegenden Umfrage ist es, zu bestimmen welchen Effekt das SLF auf die Landschaft Davos Gemeinde und den Kanton Graubünden hat. Ihre Meinung wird uns helfen, einen umfassendes Eindruck zu erhalten.

Der vorliegende Fragebogen wird an die Teilnehmerinnen und Teilnehmer dieses Workshops verteilt. Er dient dazu, hinsichtlich wirtschaftlichen Aspekten und Bildung die Wirkung des SLF auf Gemeinde und Kanton zu analysieren. Ihre Antworten werden selbstverständlich vertraulich behandelt und dienen ausschliesslich dieser Studie. Bei Fragen stehen wir Ihnen jederzeit sehr gerne zur Verfügung.

Herzlichen Dank dass Sie sich Zeit nehmen,

Mit freundlichen Grüssen,

Alex Aimetti, Matthew Black, Erich Lidstone, Antonio Sangermano

Anleitung

Die Beantwortung der Fragen dauert ungefähr 10 Minuten. Bitte geben Sie das ausgefüllte Formular an diejenige Person zurück, welche es Ihnen ausgehändigt hat.

1. Wie häufig haben Sie in den vergangenen 5 Jahren einen Kurs des SLF besucht? (den aktuellen Kurs miteingerechnet)

☐ 1 ☐ 2-3 ☐ 4-5

☐ 6-7 ☐ 8-9 ☐ 10+

1a. Haben Sie vor, in Zukunft weitere Kurse des SLF zu besuchen?

☐ Ja ☐ Nein

1b. Weshalb?

_____

_____

Bitte kreuzen Sie die Ziffer an, welche am besten passt (Fragen 2-5).

1. Überhaupt nicht einverstanden 2. Nicht einverstanden 3. Neutral 4. Einverstanden 5. Sehr einverstanden

2. Das SLF ist nützlich/förderlich für Davos und seine Umgebung.

1 2 3 4 5

3. Ich habe diesen Workshop genossen.

1 2 3 4 5

4. Ich habe in diesem Workshop viel gelernt.

1 2 3 4 5

5. Ich werde diesen Workshop einem Kollegen weiterempfehlen.

1 2 3 4 5

Bitte beachten: falls Sie nicht ständig in Davos leben, füllen Sie bitte die nachfolgenden Fragen aus. Falls doch, bitte bei Frage 14 weiterfahren

6. Sind Sie mit Begleitung nach Davos gereist, welche nicht am Workshop teilnimmt?

☐ Ja ☐ Nein

6a. Falls ja, wieviele Personen sind mit Ihnen nach Davos gekommen?_____

7. Wieviele Nächte werden Sie in Davos und Umgebung verbringen? _____

8. In welchem Hotel übernachten Sie? (bitte ankreuzen)

☐ Turmhotel Victoria ☐ Hotel Rössli

☐ Other: _____

8a. Wie viel Geld (in CHF) haben Sie (und Ihre Begleitung) pro Nacht in ihrem Hotel ausgegeben?

_____

9. Wie viel Geld haben Sie heute für Essen ausgegeben? (in CHF, Begleitung inbegriffen)

_____

10. Haben Sie Geld für Souvenirs, Kleider oder irgendwelche Aktivitäten während Ihres Aufenthalts ausgegeben? (bitte ankreuzen)

☐ Ja ☐ Nein ☐ Nein, aber ich werde noch

10a. Falls Ja, wie viel Geld haben Sie während Ihres Aufenthalts dafür ausgegeben?

_____

10b. Wie viel Geld gedenken Sie auszugeben (in CHF)?

_____

11. Welche Transportmittel haben Sie benützt um nach Davos zu kommen?

☐ Auto

☐ Zug

☐ Flugzeug (falls ja, welcher Flughafen?)

_____

☐ Andere:

_____

12. Waren Sie schon einmal in Davos in den Ferien?

☐ Ja ☐ Nein

12a. Falls nein, käme Davos für Sie nach diesem Aufenthalt als Feriendestination in Frage?

☐ Ja ☐ Nein

13. Andere Bemerkungen zum Workshop oder zu Davos

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

14. Welches ist Ihr Geschlecht?

☐ Männlich ☐ Weiblich

15. Wie alt sind Sie?

☐ 18 oder jünger ☐ 19 – 24

☐ 25 - 34 ☐ 35 - 49

☐ 50 - 64 ☐ 65 +

16. Welches ist Ihr aktueller Beruf?

_____

17. Welches ist Ihre höchste abgeschlossene Ausbildung?

☐ Schulabschluss

☐ Berufslehre

☐ Fachhochschulabschluss

☐ Hochschulabschluss

☐ Doktorat

18. Leben Sie in Graubünden?

☐ Ja ☐ Nein

18a. Falls Ja, weshalb leben Sie in Graubünden?

☐ Arbeitsmöglichkeit

☐ Herkunft

☐ Schöne Landschaft

☐ Unterhaltung

☐ Anderes:_____

18b. Falls Sie nicht in Graubünden leben, wo leben Sie?

_____

18c. Wie lange leben Sie schon an Ihrem aktuellen Wohnort?

☐ weniger als 6 Monate ☐ 6-12 Monate

☐ 1-3 Jahre ☐ 4-10 Jahre ☐ > 10 Jahre

Herzlichen Dank dass Sie sich die Zeit genommen haben, Ihre Antworten sind sehr wichtig!

Appendix B: Umfrage zum Einfluss der SLF Mitarbeitenden auf Davos

Umfrage zum Einfluss der SLF Mitarbeitenden auf Davos

Liebe SLF Mitarbeitende,

Herzlichen Dank dafür dass Ihr Euch an der gemeinsamen Studie von SLF und WPI beteiligt. Ziel der vorliegenden Umfrage ist es, den Einfluss von SLF Mitarbeitenden auf die Gemeinde Davos besser abschätzen zu können.

Dieser Fragebogen richtet sich an alle Mitarbeitenden des SLF. Um die Resultate der Umfrage richtig zu interpretieren sind wir auf eine möglichst hohe Umfrage – Beteiligung angewiesen. Die Antworten nehmen einige Minuten Zeit in Anspruch. Bitte beantwortet die Fragen nach bestem Wissen und Gewissen. Falls Ihr die genauen Zahlen nicht kennt, bitten wir Euch, zu schätzen. Die Umfrage ist als attachment diesem email angehängt und wird zudem heute Dienstag 18. November in Eurem Fach liegen. Wir wären Euch sehr dankbar, wenn Ihr die Antworten bis Montag 24. November in die bereitgestellte Box „SLF Impact“ in der Cafeteria ablegen könntet.

Der Fragebogen und die erhaltenen Daten bleiben anonym. Es werden keine Namen und entsprechende Antworten assoziiert. Die Antworten werden zu einem Bericht über die Ausgaben der SLF Mitarbeitenden hier in Davos zusammengefasst. Mitte Dezember werden die Resultate der Studie in einem SLF Kolloquium vorgestellt.

Falls Ihr Fragen habt, so wendet Euch bitte per email an uns WPI Studierende SLFresearch@wpi.edu, sprecht uns beim Café an, oder ruft an unter 363.

Herzlichen Dank für Eure Zeit,

Alex Aimetti, Matthew Black, Erich Lidstone, Antonio Sangermano

Anleitung

Bitte lest jede Frage sorgfältig und beantwortet sie nach bestem Wissen und Gewissen. Bitte den ausgefüllten Fragebogen in die Box "SLF Impact Survey" in der Cafeteria einwerfen.

1. Wie viel Geld (in SFr.) gebt Ihr durchschnittlich in den folgenden Kategorien aus? Bitte beachtet alle Aspekte (z.B. Après-Ski, auch wenn noch nicht richtig Saison ist). **Bitte hier nur die Ausgaben IN der Landschaft DAVOS.**

a. Nahrungsmittel und Getränke: _____

b. Bekleidung und Schuhe: _____

c. Wohnen und Energie: _____

d. Wohnungseinrichtung und laufende Haushaltsführung: _____

e. Gesundheit (Zahnarzt, Apotheke, etc.): _____

f. Priv. und Öff. Verkehr: _____

g. Telefon, Internet, Post _____

h. Sport und Kultur: _____

i. Weiterbildung, Kurse: _____

j. Restaurants _____

k. Versicherungen _____

l. Ferien _____

m. Andere Waren und Dienstleistungen: _____

2. Wie viel Geld (in SFr.) gebt Ihr durchschnittlich in den folgenden Kategorien aus? Bitte beachtet alle Aspekte (z.B. Après-Ski, auch wenn noch nicht richtig Saison ist). **Bitte hier die Ausgaben AUSSERHALB Davos. ihihihuuhuhui**

n. Nahrungsmittel und Getränke: _____

o. Bekleidung und Schuhe: _____

p. Wohnen und Energie: _____

q. Wohnungseinrichtung und laufende Haushaltsführung: _____

r. Gesundheit (Zahnarzt, Apotheke, etc.): _____

s. Priv. und Öff. Verkehr: _____

t. Telefon, Internet, Post _____

u. Sport und Kultur: _____

v. Weiterbildung, Kurse: _____

w. Restaurants: _____

x. Versicherungen: _____

y. Ferien: _____

z. Andere Waren und Dienstleistungen: _____

3a. Hast Du in den vergangenen 5 Jahren ein neues Wohnhaus bauen oder renovieren lassen?

□ Ja, in Davos

□ Ja, ausserhalb von Davos

□ Nein

3b. Wie viel Geld hast Du dafür ausgegeben? _____

3c. Falls Du in den vergangenen 5 Jahren mehr als ein Wohnhaus gebaut oder renoviert hast, bitte die Fragen 3a-3b für jedes Gebäude separat unten angeben.

4a. Gibt es andere grosse Ausgaben die Du in den vergangenen 5 Jahren getätigt hast, welche nicht eingerechnet sind in die obigen durchschnittlichen Ausgaben? (neues Auto, etc.)?

□ Ja, in Davos

□ Ja, ausserhalb Davos

□ Nein

4b. Falls ja, in welche der Kategorien aus Frage 1 passt es am besten? _____

4c. Wie viel Geld hast Du dabei ausgegeben?_____

4d. Falls Du mehrere grosse Ausgaben getätigt hast, bitte beantworte die Fragen 4a-4c für jede grosse Ausgabe hier separat.

5. Kommen Dir weitere Ausgaben in den Sinn, die Du für wichtig hälst, wir aber oben nicht aufgeführt haben? Falls ja, bitte auflisten.

6. Hast Du weitere Bemerkungen oder Kommentare die unsere Studie betreffen und für uns wichtig wären?

7. In welcher Funktion arbeitest Du am SLF?

□ DiplomandIn/Lehrling/PraktikantIn

□ DoktorandIn

□ Technisches und wissenschaftliches Personal/Administration/Führungskräfte

8. Wo lebst Du?

□ Davos (Inklusive Wolfgang, Frauenkirch, Monstein, Sertig, Clavadel)
□ Andere Orte Graubünden
□ Andere Orte Schweiz

9. Falls Du in Graubünden wohnst, würdest Du ebenfalls hier wohnen falls das SLF nicht in Davos wäre?

□ Ja □ Nein

Herzlichen Dank dass Du Dir die Zeit genommen haben, Deine Antworten sind sehr wichtig!