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► **To cite this version:**

Sophie Clusel, Franck Guarnieri, Christophe Martin, Didier Lagarde. Assessing the vulnerability of SMEs: a qualitative analysis. 22nd European Safety and Reliability Conference - ESREL 2013, Sep 2013, Amsterdam, Netherlands. 8 p. - ISBN 9781138001237. hal-00871061

HAL Id: hal-00871061

<https://minesparis-psl.hal.science/hal-00871061>

Submitted on 23 Oct 2013

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Assessing the vulnerability of SMEs: a qualitative analysis

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ABSTRACT: The Very Small Business (VSB) and the Small or Medium-sized Enterprise (SME), like any other socioeconomic entity, faces multiple risks (fire, loss of a major supplier, work-related accidents, failure of a partnership, industrial espionage, etc.). However, unlike their larger counterparts, they do not have at their disposal dedicated tools for global risk management and thus lack ways to ensure their sustainability. In this context, the AFNOR Group, in collaboration with the Centre for Research on Risks and Crises of MINES ParisTech, carried out a research project to address this issue.

INTRODUCTION

The aim of the research was to develop an overall control process for risk management in VSBs/SMEs. The approach is based on a diagnostic tool that can highlight the vulnerabilities of VSBs/SMEs to their principal risks. The tool that was developed was based on the identification and prioritization of various vulnerability criteria that cause variations in the nature and severity of damage when an undesired event occurs. These vulnerability criteria were selected on the basis of results obtained from a structural analysis.

This article is organized into three sections. The first describes the approach adopted to reduce vulnerabilities in the context of the overall risk management procedures of VSBs/SMEs. The second part describes the methodology used to identify and select the vulnerability criteria, while the third part discusses the results and how they were used in the construction of the diagnostic tool.

1 VULNERABILITY REDUCTION IN THE VSB/SME

This section describes the fundamental elements of our approach to reducing the vulnerabilities of the VSB/SME. It is organized into three sub-sections. The first deals with the failure of the VSB/SME, while the second presents the concept

of the business life cycle, which is used as an explanatory factor. Finally, the third sub-section describes the vulnerability model.

1.1 The high mortality rate of the VSB/SME

In France in 2011 almost 60,000 companies began legal proceedings related to business failure (Altares, 2012). These figures should, however be revised as they only show the visible face of failure: many more businesses fail without entering into administrative procedures! Failure is only officially recorded when the company enters into either or liquidation proceedings at a Commercial or High Court. Table 1 is an initial demonstration of the high mortality rates of small companies compared to their larger counterparts.

Table 1: Number of business failures according to the size of the workforce (Altares, 2012)

Workforce	Total	Liquidation	Administration
0 emp. or unknown	25,724	19,535	6,189
1 or 2 emp.	15,808	10,995	4,813
3– 5 emp.	8,337	5,158	3,179
6– 9 emp.	4,076	2,209	1,867
10 – 19 emp.	2,588	1,246	1,342
20 – 49 emp.	1,253	435	818
50 – 99 emp.	247	59	188
100 or more emp.	162	40	122
Total	58,195	39,677	18,518

This shows that companies who have fewer than 10 or 20 employees respectively represent 92.7% and 97.1% of the total number of failures.

One observable indicator of the fragility of the VSB is a comparison of the percentage of companies going into liquidation and those entering administration. This highlights that the probability that the business is able to continue to operate as a going concern following an incident increases with the size of the organisation. There are several potential explanations for this finding. The first lies in management deficiencies that are more frequent in small businesses. The second lies in the strong commitment of the owner to their business and a failure to separate personal and professional affairs. This can lead, in an already critical situation, to a refusal to give up and resorting to funding the business from personal or family resources. These two points underline that the late detection of the problem or a particularly delicate situation inevitably leads the organisation to liquidation.

1.2 The life cycle as an explanatory factor for VSB/SME vulnerability

Various explanatory factors are commonly advanced to analyse business failure. Examples include geographical location, sector, legal form, and age of the company (Clusel, 2012). However, the work of Crutzen (2009) resulted in the emergence of a particular factor: the business life cycle.

The life cycle model used here is that developed by M. Scott and R. Bruce (Scott and Bruce, 1987). Taking as a basis the general model developed by Greiner (1972), it specifies for small businesses, different phases of development according to the age and size of the business. The model is based on two distinct parts, which are the “product” lifecycle that is linked to the parametric characterization of the company.

The product life cycle is divided into five intervals (creation, survival, growth, maturity and expansion) that are separated by a crisis that materializes as a transition phase that leads to a higher level.

These five intervals correspond to a particular company configuration and are materialised by eleven parameter scales which include, for example: the maturity of the sector, the main problems encountered, the management style, etc.

This concept makes it possible to concentrate on business practices that can sustain the activities of the VSB. The approach has two advantages.

The first lies in the identification of the transitional nature of business vulnerabilities

(Clusel, 2011a). For example, it appears that when faced with a loss of customers, a business in the creation phase (which only sells one type of product or service through a simple distribution chain in a single market) will be more vulnerable than a business in the growth phase (which sells a range of products or services through various distribution chains and undertakes marketing activities). Conversely, a newly-created company will be less vulnerable than a business in the growth phase when faced with a lack of general managerial experience as the growing organisation has a need for the delegation and coordination of roles and responsibilities.

The second advantage of this concept is that by stipulating that, “managing a business is to manage risks and opportunities”, it looks at business practices from a risk management perspective (ISO 31000, 2009). In the same vein Hillson (1997) proposes a maturity model based on four distinct levels.

The first is “naïve” and corresponds to a state where the company is not aware of its risks and therefore the need to manage them.

The second is termed the “novice” state; it embodies the first signs of risk management in a small group of people working for the company.

The third is called the “normal” state of risk management. At this stage, the company has a formalized approach and understands the benefits of its implementation at all levels of the company.

The fourth is the so-called “natural” state, which includes companies that take a proactive approach to risk management. In this case, the company’s risk culture makes it possible to consider incorporating elements resulting from the management of opportunities.

While this maturity scale is an interesting starting point, it is nevertheless difficult to calculate on the basis of the needs and potential of specific entities such as the VSB/SME, despite their heterogeneity. In this case, it is more appropriate to focus on the transition from the naïve to the novice state as it is during this time that the first signs of the future components of a risk management system are likely to appear.

1.3 The VSB/SME vulnerability model

The VSB/SME vulnerability model is based on three components described in this sub-section: events that can lead the company towards its demise (1.3.1), the functional sub-model of the VSB/SME (1.3.2) and the consequences sub-model (1.3.3).

1.3.1 Events

Selected events are organized according to the seven categories shown in Table 2.

Table 2: Examples of events

Category	Example event
Opportunities	Sudden loss of customers, poor market evaluation, obsolete products, etc.
Strategy	Conscious acceptance of unprofitable markets, failure of major projects, etc.
Production	Excess capacity, sudden loss of a supplier, etc.
Finance	Excessively long delivery times, excessively high interest rates, etc.
Management	Discontent amongst the management team, poor stock assessment, etc.
Accident	Accidents, disputes with private partners, fraud, etc.
Macroeconomic environment	Unfavourable change in exchange rates, increased competition, etc.

1.3.2 The functional sub-model of the VSB/ SME

In order to determine how an event will impact the company, the structure of the VSB is represented by a functional model. This model consists of six distinct functions: management, production, administration, sales/commerce, human resources management and financial.

1.3.3 The consequences sub-model

1.3.3.1 Nature of damage

The selected typology is that proposed by the Insurance Institute of America.

With respect to company assets, Head and Horn (2003) distinguish between fixed property assets and other fixed assets which are split into tangible and intangible capital assets. The decision was made to highlight two particular elements, namely loss of image or reputation and loss of information.

Company responsibilities include both civil and criminal liabilities. In this case we decided to focus specifically on the legal penalties that result from corporate responsibility commitments.

Damage that is due to the actions of company employees must integrate several distinct aspects. Although direct members of the company (employees, key personnel, etc.) and those who are indirectly associated with the business (shareholders, consultants, etc.) are the principal constituents of this group, it may also be relevant to include their family (partner, child(ren), etc.). This is particularly relevant in the context of increased social proximity, as is the case for the VSB.

Finally, loss of income or production can result from the three types of damage previously described. While it is relatively easy to identify tangible consequences (e.g. loss of revenue resulting from a machine that has broken down), it is more difficult for intangible impacts. While the loss of an operating license or approval may result in reduced income associated with lost market opportunities, it can also be the origin, in the longer term, of a loss of credibility within the company's network, which is difficult to quantify as it depends on the nature of the company's relationships.

1.3.3.2 Severity of damage

In order to simplify the presentation, the severity of consequences is looked at only in terms of two aspects (see Table 3).

The first is related to disruption to the overall activity of the company. The second relates to the organization's finances.

Table 3: Selected impact of damage

Activities	Minor impact on activity	Finances	Minor impact (less than 15% loss of liquid assets)
	Moderate short-term impact		Moderate impact (less than 50% loss of liquid assets)
	Serious short/medium-term impact		Serious impact (equal to 100% loss of liquid assets)
	Very serious short/medium/ long-term impact		Very serious impact (equal to 100% of liquid assets + X% of capital reserves)

This first section has described our approach to reducing the vulnerabilities of the VSB/SME. The first sub-section highlighted the very high current levels of VSB/SME mortality. The second introduced the concept of the life cycle that was used subsequently in the third sub-section to demonstrate the various elements implemented in modelling the vulnerabilities of the VSB/SME.

2 METHOD

This second section concerns how the vulnerability criteria of VSBs/SMEs were selected based on the model presented in the previous section. The first sub-section discusses how they were identified, while the second describes them. Finally, the third sub-section outlines how they were prioritized on the basis of a structural analysis.

2.1 Identification of vulnerability criteria

The nature and impact of unwanted events depend on the characteristics of the organization in which

they occur. Consequently, there is a need to identify the variables that influence the various levels of acceptability associated with a given adverse event.

A deductive approach was taken that was based on a damage typology. The typology was established on the basis of an inventory of consequences caused by the occurrence of an adverse event.

Vulnerability criteria were identified on the basis of an examination of thirty-six selected events that were each compared with the functional model. Next, a damage typology was established, i.e. the various combinations of type and severity of damage. The objective was to arrive at a selection of factors that influenced the vulnerability of the VSB when faced with an external event. Taking the example of the event ‘loss of a major supplier’, the production function is directly affected and has an impact on property and people amongst others.

With respect to property damage, the joint capital of the company is affected. It is difficult to estimate the financial impact given that the value creation/revenue generation of this type of resource is complex. Nevertheless, it is likely that the impact of property damage in financial terms caused by the loss of an important supplier depends on the financial health of the VSB/SME, the exact nature of the relationships between the VSB and the supplier, and the number of suppliers that the company has for the same product and/or service, etc. In terms of disruption to activities, the impact depends on the type of production of the company, its level of functional interdependence, the responsiveness of its owner and workers, etc.

With respect to personal injury, it is particularly useful to focus on the head of production. Although it is equally difficult to assess the financial impact of this type of damage on people as it is for property, this does not appear to be the case for disruption to activities. Depending on how critical the supplier is in relation to the company’s activities, the head of production will naturally look at finding a replacement that may improve or have an adverse effect on ‘normal’ production activities. In this case, it can be argued that the impact of disruption to activities of the loss of a major supplier depends on the management style of the VSB/SME, how competent the head of production is, and the collective and individual ability to adapt.

This approach led to the identification of 246 vulnerability criteria. It was impractical to work with such a long list, and the criteria were therefore grouped. Rather than considering the criteria “the financial health of suppliers, “the financial health of lenders”, “the financial health of customers”, etc. the criterion “financial health of stakeholders” was selected.

This first restriction reduced the number of criteria used in the model to 96.

2.2 VSB/SME vulnerability criteria

The vulnerability criteria previously identified were organized into the eight categories shown in Table 4.

Table 4: Categories used for organizing vulnerability criteria

Vulnerability criteria categories			
Human Resource Management	Financial management	Sales/Commercial	
Administration	Production	Management	
All business functions	Stakeholders		

As an example, criteria relevant to the Management function concerned the owner(s), their activities and the decisions they must take (see Table 5).

Table 5: Criteria associated with the Management function

Criterion	Detail
C22 – State of relations between owner(s)	Poor management team relations are very unfavourable for the development of strategy and the decisions that must be taken concerning the company’s various activities.
C37 – Motivation of shareholders/ associates/ owners, etc.	According to their individual objectives, shareholders/ associates/ owners take a different approach to decisions.

Similarly, criteria related to the Sales/Commercial function concern sales activities and those of the actors involved in this process – customers, suppliers, competitors, etc. (see Table 6).

Table 6: Criteria associated with the Sales/Commercial function

Criterion	Detail
C59 – Number of clients	A company that only has one customer is highly dependent on that customer.
C50 – Diversification of customer base	Similarly, a company whose client base is too homogeneous is reliant on the economic climate of a sector, or a particular customer type.

2.3 Prioritization of vulnerability criteria

The deductive approach highlighted 246 vulnerability criteria that could influence the impact of an event on the VSB. From these, 96 were finally selected.

The next step was to prioritize these criteria using a structural analysis. Structural analysis is a tool for structuring ideas that describes a system using a matrix that links all of its constituent components. An examination of these relationships enables variables to be highlighted that appear to be key to the evolution of the system (Godet, 2001). It is then possible to demonstrate (or not) how important these criteria are in characterizing the vulnerability of the company. Structural analysis is carried out in two main stages. The first involves the identification of relationships between variables and the second concerns the construction of influence/dependency plans.

2.3.1 Construction of the Boolean matrix

A Boolean matrix demonstrates the relationships between variables (an extract is shown in Table 7). This is a square matrix where both the rows and columns contain the 96 predetermined vulnerability criteria, which are compared on a one-by-one basis. If there is a demonstrated influence of criterion *I* on criterion *J* a 1 is noted in the corresponding box in matrix *A*. Otherwise, a 0 is recorded.

Table 7: Extract from the Boolean matrix *A*

		C1	C2	..	Sum
		Economic and financial health of stakeholder	Impact of damage	..	
C1	Economic and financial health of stakeholders	1	66
C2	Impact of damage	1	1	..	80

Sum		36	67

This step is completed by the calculation of the sum of each row and column in order to obtain, for all criteria, its Cartesian coordinates, i.e. abscissa and ordinate values.

2.3.2 Preparation of the initial influence/dependency plan

The set of previously calculated coordinates is used to develop influence/dependency plans where the *X* axis demonstrates dependence and the *Y* axis represents the influence of the criterion on the system. The scatter plot obtained from these coordinates makes it possible to qualify variables using the rules shown in Table 8.

Table 8: The initial influence/dependency plan (adapted from Godet, 2001)

	Low X	Average X	High X
Low Y	Excluded variables	Pack variables	Result variables
Average Y	Pack variables	Pack variables	Challenge variables
High Y	Driving variables		

Excluded variables are considered minor, i.e. these criteria have little or no importance for understanding the system.

Pack variables do not individually play a major role in the functioning of the system, but they must be included in the analysis because they are important in terms of their influence and/or dependency.

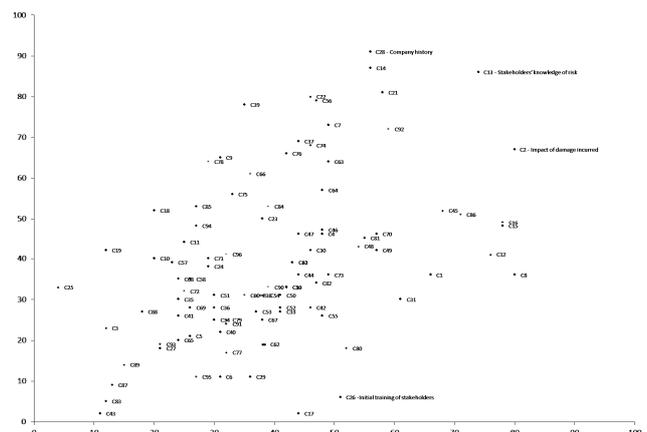
Driving (input) variables characterise criteria that have a significant influence on the dynamics of the system.

Result (output) variables represent criteria that are most dependent on others, i.e. their state and changes in that state depend on that of the system.

Challenge variables demonstrate the dual nature of influence and dependency. These criteria are interesting because of their instability. Changing the state of these variables makes it possible to act on the driving variables and the outputs for which they act as relays.

The initial influence/ dependency plan (see Figure 1) demonstrates the direct interactions between variables.

Figure 1: The initial influence/dependence plan derived from matrix *A*



The very dispersed scatter plot shown in Figure 1 highlights the instability of the system. However, some criteria immediately stand out. These include criteria C28 (Company history), C13 (Stakeholders' knowledge of risk), C2 (Impact of damage), etc.

Matrix A is then successively raised to the power of two, three and four with two objectives. The first is to accentuate the graphical distribution in order to better differentiate between variables or sets of variables. The second is to highlight indirect interactions through a comparison of the various associated influence/dependency plans.

This second section has explained the steps that were taken to select the vulnerability criteria that were used to build the diagnostic tool. The first sub-section described how criteria were identified. The second described these criteria in terms of the various business functions. Finally, the third introduced the structural analysis technique used to prioritise vulnerability criteria.

3 THE DIAGNOSTIC TOOL

This section describes the processes that ended in the validation of the vulnerability diagnosis tool. It is organized into three sub-sections. The first presents the results of the structural analysis which provided the basis for the tool. The second sub-section describes the tool itself, and finally, the third sub-section outlines the experiments undertaken.

3.1 Results of the structural analysis

On the basis of the findings described above, it was possible to determine the character of each variable and therefore select groups of variable to be used in the construction of the diagnostic tool.

For example, the selected Challenge variables were:

- C1 – Economic and financial health of stakeholders (customers/ suppliers/ subcontractors, etc.)
- C2 – Percentage of the business affected by the event (the impact of damage)

The selected Driving variables were:

- C7 – Capacity to adapt to individual/ group change, etc.
- C14 – Business climate (social, cultural climate, etc.)

No Result variables were identified.

Excluded variables were:

- C3 – Accessibility of land/ buildings (security + access)
- C27 – Legal form of the company (capitalistic, social, fiscal, etc.)

Finally, the Pack variables were:

- C4 – Correspondence between the workforce and the company's activities
- C29 – Geographical location of the company

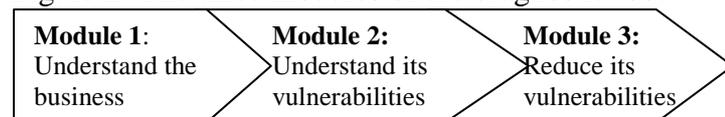
These elements provided the foundations for the diagnostic tool described in the next sub-section.

3.2 The diagnostic tool

The diagnostic tool is not a methodological guide to be used by the VSB for a review of the various aspects of the organization. Nor is it a financial or banking tool for the diagnosis of the usual ratios or other elements – usually carried out in order to obtain a loan – for example. On the contrary, it aims to identify weaknesses in the VSB from a global risk management perspective, to offer potential ways to improve the organization's situation, and to raise owners' awareness of the relevance of a risk-oriented approach to the general conduct of their activities and those of the company.

The tool is based on 19 questionnaires and five worksheets (Clusel, 2011b). It consists of three modules (see Figure 2).

Figure 2: The three modules of the diagnostic tool



These three modules are divided into nine steps.

Module 1 is organized into four questionnaires and corresponds to the first diagnosis step in which the company is characterised (see Table 9).

Table 9: Representation of Module 1

MODULE	STEP	TOOLS
Module 1: Understand the business	Step 1: Characterise the organisation concerned	Questionnaire 1 – Corporate identity
		Questionnaire 2 – Corporate structure
		Questionnaire 3 – Stage of development of the company
		Questionnaire 4 – Stakeholders' knowledge of the company

The second module is organized into six distinct steps composed of fifteen questionnaires and a worksheet. The aim is to characterise the vulnerabilities of the business.

The third module is organized into two steps consisting of four worksheets. The aim is to characterise the reduction of the company's vulnerabilities (see Table 10).

Table 10: Representation of Module 3

MODULE	STEP	TOOLS
Module 3: Reduce vulnerabilities	Step 8: Draw up action plans	Worksheet B – Select measures for vulnerability reduction
		Worksheet C – Plan measures for vulnerability reduction
	Step 9: Monitor the implementation of action plans	Worksheet D – Implement vulnerability reduction measures
		Worksheet E – Monitor vulnerability reduction measures

3.3 Validation of the diagnostic tool

The general protocol was organized into three distinct experiments (see Table 11).

Table 11: Summary of experiments

Experiment	Main objective	Number of companies	Progress
1	Questionnaire validation	2	Finalized
2	Validation of the method of administration	5	Finalized
3	General validation	At least 50	To do

Experiments 1 and 2 were carried out respectively with two and five firms (see Figure 3).

Figure 3: Characteristics of some participating companies

Company	Activities	Year established	Workforce (official)	Percentage of activities carried out as a sub-contractor activities	Training of owner	Legal form	Maturity*
1	Hospitality	2007	2.5	1 – 25%	Technical	Limited Liability Company	Survival
2	Metallurgy	1984	1	1 – 25%	Technical	Sole Proprietorship	Creation

* For the purposes of the diagnostic instrument, the maturity of the company was established by a score determined partially on the basis of the Scott and Bruce (1987) model,

which was supplemented by other elements concerning the structure of the company and knowledge of its stakeholders.

3.3.1 Experiment 1

The aim of the first experiment was to ensure that it was actually possible to administer the questionnaire to the target group, in terms of both logic and the understanding of terminology and semantics. The findings led to a thorough reorganization of the questionnaire in order to significantly reduce the time taken for its administration.

3.3.2 Experiment 2

The aim of the second experiment was to validate the proposed tool, i.e. check consistency and relevance to the target user.

The first meeting with each of the five business owners provided the data necessary for the administration of modules 1 and 2. At the second interview participants were informed of the results of the previous meeting and the evaluation of the diagnostic method. The evaluation was based on an assessment of the form and the general content of the questionnaires, and the relevance of the results of the diagnosis.

The general form of questionnaires and worksheets was said to be satisfactory by all participants. However, it appeared that participants from companies three and five found some elements complex.

With respect to the overall content of the questionnaires and worksheets, comprehension levels ranged from average to excellent.

In terms of the relevance of the results of the diagnosis, all participants found the duration of the intervention (approximately four hours of diagnosis plus two hours for the feedback of results) as good. At this time, the duration of the intervention was not changed, and improvements were focused on content optimisation (details of particular points, addition of general and specific themes, etc.).

Overall, participants were satisfied with the coherence of the results of the diagnosis compared to the situation of the company.

Finally participants were asked for their views concerning the usefulness of the results of the diagnosis. This feedback tended to confirm the value of the exercise. For example, participants mentioned that the division of the organization into functions was useful for less mature companies as it provided a different view of the

business. Others perceived the diagnosis as an opportunity to “take a moment to make an overall assessment of activity”.

The results of this second experiment identified gaps, errors, and weaknesses of the tool that it will be necessary to review.

3.3.3 Experiment 3

The third experiment is still being organised. It is aimed at a broader validation of all elements of the vulnerability diagnosis. It will require the cooperation of at least fifty small businesses in a given territory. These constraints mean that it may be appropriate to focus on a particular sector or specific activity. The tool used in experiment 3 will be based on collective action as described by ANACT (2004). The results of this experiment will enable the final modifications to be made that will lead to the definitive version of the instrument.

This section described the construction and validation of a vulnerability diagnosis tool for the VSB/ SME. The first sub-section described how criteria were identified through a structural analysis, while the second presented the diagnostic tool that was developed. Finally, the third sub-section outlined the experimental protocol implemented to validate it.

CONCLUSION

Despite these initially encouraging results, many improvements remain to be made particularly in terms of the diagnosis of vulnerability in the VSB/ SME.

In the weeks and months ahead, the design and organization of a larger-scale experiment will continue. This experiment aims to consolidate knowledge on how target companies can take ownership of the tool.

In this experiment, it will be particularly interesting to look at the adjustments made to the various supporting materials and how they are used. The aim is to evaluate which components of the tool can be used by the business owner without external help and identify those that need further support in order to be implemented. It will look at the necessary conditions for business owners to take ownership of the risk management process. This will require further specific work on the development of vulnerability reduction measures that could be supported by the partners

of small organisations (Chambers of Commerce and Industry, professional associations, etc.).

This larger-scale experiment will require a methodology based on collective action. It must guarantee that the expectations of different actors (businesses, project managers, partners, etc.) are taken into account, and be able to describe the form of individual and collective results. It will also integrate adjustments to the model, in order that it responds better to the concerns of various actors in a sector and/or territory. Finally, it must formally define the processes and objectives to be met in the context of discussions about the generation of vulnerability reduction plans.

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