CLIMATE RISK SENSITIVITY ASSESSMENT TOOL

Implementation Guide for Banks

June 2019

SITAWI
FINANCEforGOOD

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Introduction

In March 2019, FEBRABAN proposed a set of actions for the Brazilian banking system to implement the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). These Recommendations are an initiative of the G20 Financial Stability Board (FSB) to support the dissemination of financial information related to climate change, enabling financial institutions and companies to improve their risk management and climate opportunities. In its recommendations, the TCFD identifies the most critical sectors regarding exposure to climate risks. The reporting of information on these sectors, such as oil and gas, agriculture, chemical and mining, should receive priority attention, both by the companies that work in them, as well as by the financial institutions.

To assist banks in this TCFD implementation trajectory, FEBRABAN has developed the Climate Climate Risk Sensitivity Assessment Tool, a tool that allows an analysis of the sensitivity of the banks' credit portfolio to climate risks. The tool has two objectives:

I. Enable the prioritization of actions related to climate risk management;
II. Enable the materiality analysis of the TCFD Recommended Disclosures for the bank.

The tool was developed together with the Working Group on Climate Risks and tested on pilot mode by some banks. This is an Implementation Guide.

Principles and scope

Principles used for the elaboration of the Tool

- **The operations carried out by banks have different levels of sensitivity to climate risk.** In credit operations, a series of variables will determine the sensitivity to climate risk. These variables include, for example, the nature of the activity supported, its location and the amount of the operation.

- **The assessment of the climate risk sensitivity of a financial institution can be made at different levels of detail** and may offer a diagnosis of part of the portfolio (e.g. an operation, a client or a sector portfolio), the bank's full credit portfolio or all of its operations, including management of third party assets, for example.

- **Sensitivity must be identified from the combination of principles of relevance and proportionality**, in line with CMN - Comissão Monetária Nacional (National Monetary Council) Resolution 4327/2014. For the purpose of applying this System, it is considered:

  I) **Relevance:** level of exposure to the climatic risk of economic activities financed by the institution.
  I) **Proportionality:** associated with the nature of the operations of the financial institution and the complexity of the set of products and services offered.

- It should be noted that **there are limitations to the identification of relevance and proportionality:** some variables that may determine relevance and proportionality, such as the location of the activities financed and the precise allocation of resources captured by the client, are not captured by the banks in all operations, either by their own characteristics (e.g. working capital) or by the difficulty in obtaining the information. **Part of these limitations can be addressed by reviewing the tools and/or systems adopted by the bank for client and operation analysis or alternatively, by assessing sensitivity at different levels of detail and using proxies**.

Scope

The Tool was developed for application by financial institutions, in credit operations for legal entities[1].

[1] For farmers, the third layer of the ruler can be adapted by banks.

Climate Risk Sensitivity Assessment Tool Application Dynamics

The Tool was designed to be applied in three layers. From the first to the third, the granularity of the analysis increases progressively and thus also increases the degree of effort and sophistication of the analysis. The layers can be applied sequentially or individually. This option will depend on the degree of information the bank has available on its portfolio and the expected results.

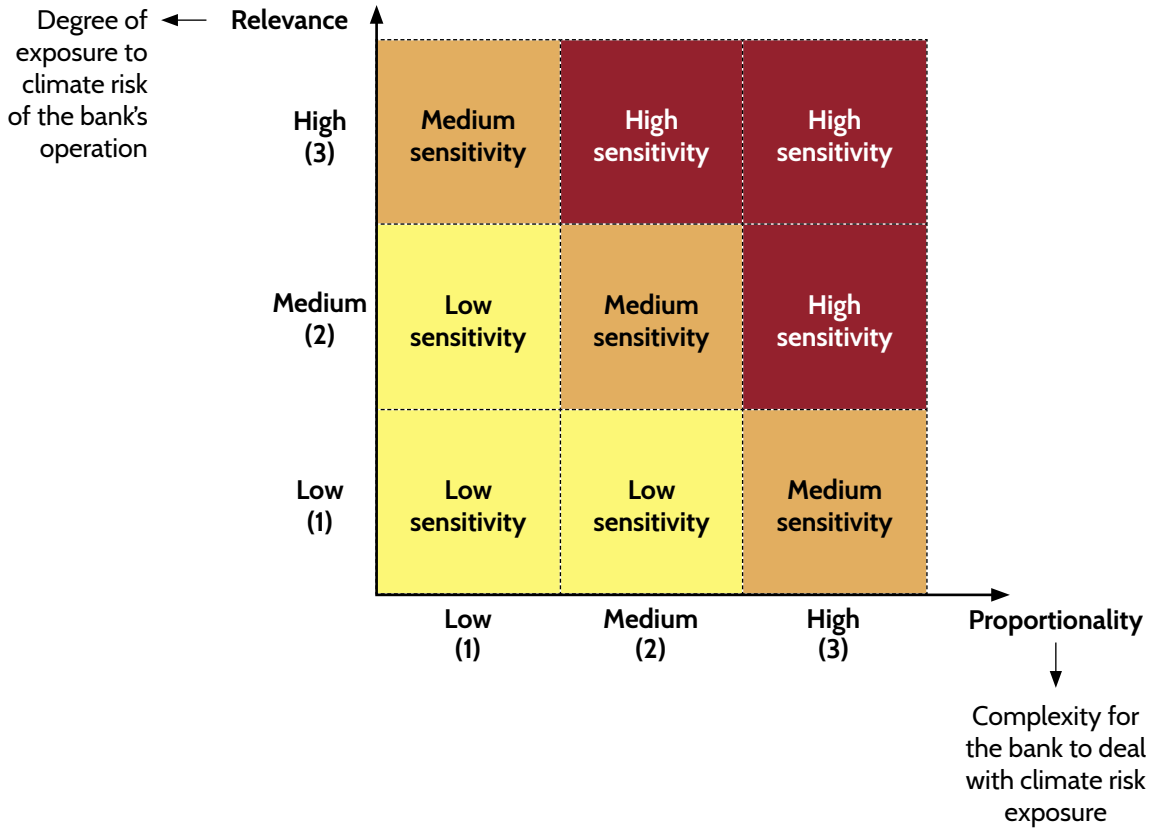
Therefore, the sensitivity analysis may offer a diagnosis of part of the portfolio (of an operation, a client or a sector portfolio) or the bank's whole credit portfolio, obtained by combining the sensitivities of the sector portfolios.

Elements of the Climate Risk Sensitivity Assessment Tool

Layers (by unit of analysis)	Principles		Expected messages
	Relevance	Proportionality	
SECTOR Sectorial portfolios that make up credit portfolio	1. Nature of the economic sector activities 2. Quality of the economic sector portfolio (based on rating)	1. Amount of the active credit portfolio of the economic sector	• Degree of sensitivity of the portfolio, in a macro look, that does not demand great detailing effort • More sensitive sectors • Reasons that contribute to greater sensitivity
CLIENTS Clients who make up a sector portfolio	1. Nature of activities 2. Client Rating	1. Weighted average term of the client's operations 2. Exposure per client	• Clients to be prioritized in climate risk management • Reasons that contribute to the greater sensitivity of the clients that make up the sector portfolio
CREDIT OPERATIONS Operations which make up a client's portfolio	1. Nature of activities 2. Operations Rating 3. Locational climate risk of the operation	1. Operation tenor 2. Operation amount	• Operations to be prioritized in climate risk management • Reasons that contribute to client sensitivity • Need for adjustment in the process of granting credit and monitoring operations

In each layer, the dynamics will be the same:

1. Analyze the relevance of the climate risk to the analyzed portfolio, categorizing it as low, medium or high;
2. Analyze the proportionality of the climate risk to the analyzed portfolio, categorizing it as low, medium or high;
3. Combine the categorization of relevance and proportionality, resulting in a categorization of portfolio sensitivity: low, medium or high.



Application of the Tool on economic sectors – LAYER 1

The first layer of application of the tool consists in the assessment of the sensitivity of the sectoral portfolios that, together, make up the bank's credit portfolio. Thus, the analysis at the level of sectoral detail, when complete, allows the identification of the level of sensitivity of the credit portfolio as a whole.

The variables of relevance and proportionality that should be considered in the analysis in this first layer are summarized in the table below:

RELEVANCE	PROPORTIONALITY
1. Nature of the activities in the economic sector 2. Portfolio's quality in the economic sector (based on rating[2])	1. Active credit portfolio amount in the economic sector

In all variables evaluated in the first layer, the economic sector of the financed activities should be understood as the sector classification based on the National Classification of Economic Activities [CNAE - *Classificação Nacional de Atividades Econômicas*] codes, more specifically, the CNAE Division corresponding to the economic sector, since this is the classification usually used by Brazilian banks. It is recommended that the CNAE Division be identified on the National Registry of Legal Entities [CNPJ - *Cadastro Nacional da Pessoa Jurídica*] of the client.[3]

[2] Here and throughout the implementation guide of the sensitivity tool, the mentioned rating is the traditional and not the socio-environmental rating, if the bank already has this type of analysis.

[3] For banks that do not classify according to CNAE, the classification used should be matched.

Relevance on economic sectors

The first step in determining the relevance of climate issues to a bank is to analyze the climate risks derived from the sectoral characteristics of its credit portfolio. Thus, the identification of the level of exposure to climate risk at the sectorial level is based on the following variables:

VARIABLE	RATIONALE
1. Nature of activities of the economic sector	The nature of the activities can be **high**, medium or low exposure to climate risks. In 2017 the TCFD defined a list of sectors with the greatest exposure to climate risks, considering energy consumption, greenhouse gas (GHG) emissions and typical water consumption of the activities in these sectors. In addition to these, we propose in this tool the classification of some other sectors such as average exposure, considering water consumption, energy consumption, GHG emission and direct dependence of high exposure sectors. All others that do not fall under any of the two categories above are considered as low exposure. For all these sectors, a correspondence was made with the CNAE Divisions, typically used by banks in Brazil to classify their credit operations.
2. Portfolio quality of the economic sector	The quality of the sectoral portfolio may be high, medium or low. Quality is defined based on the percentage of portfolio amount that is categorized as investment grade. The worse the quality of the portfolio, the nearer there is a risk of becoming a loss to the bank.

The sectors of **high** and medium exposure are listed in Appendix I. The sectors not included in these categories above should be considered of low exposure to climate risk.

Nature of Activities of low exposure	Nature of Activities of medium exposure	Nature of Activities of high exposure
All the activities that are not classified as medium and high exposure	CNAE Division: 12, 13, 14, 15, 21, 22, 23, 26, 27, 29, 30, 31, 33, 36, 64, 65	CNAE Division: 01, 02, 05, 06, 07, 08, 09, 10, 11, 16, 17, 19, 20, 24, 25, 28, 29, 35, 41, 42, 43, 49, 50, 51, 52, 68

From this first assessment, the value of the first variable is obtained: low, medium or high exposure. The greater the sector exposure according to the detailed scale above the greater the relevance of the sector.

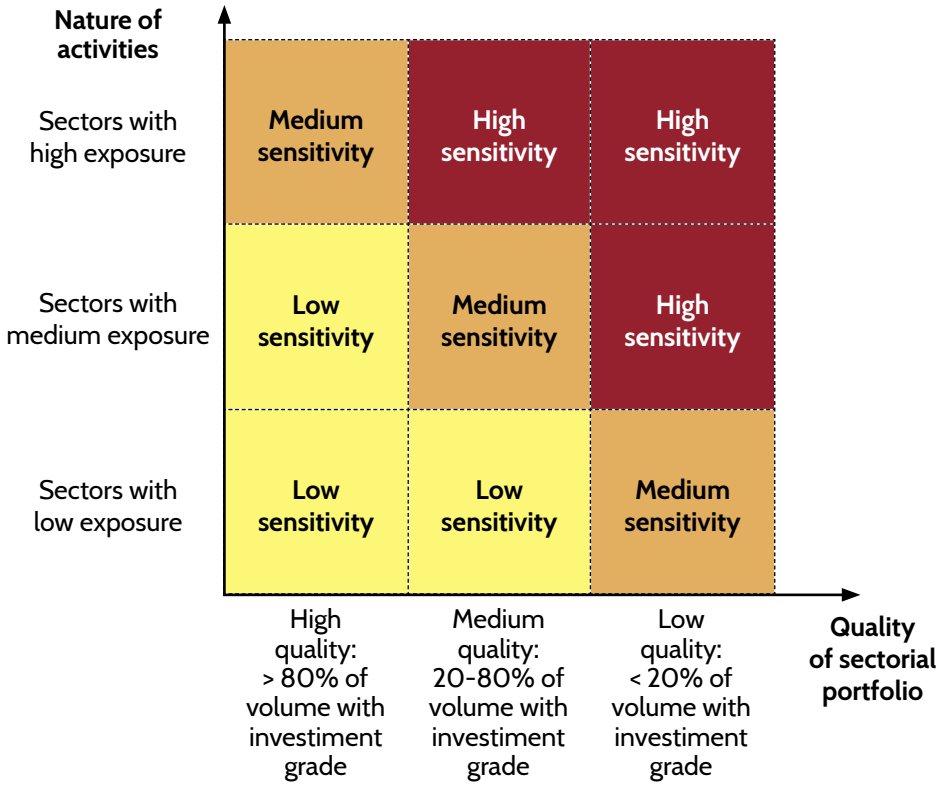
Low quality of sectoral portfolio	Medium quality of sectoral portfolio	High quality of sectoral portfolio
<20% of the amount of the investment level	≥20% to 80% of the amount of the investment level	>80% of the amount of the investment level

In this case, the worse the quality of the portfolio the higher its relevance, since the closer is a risk of becoming a financial loss for the bank.

To be classified as an investment grade, the portfolio's credit rating must be between AA and A.

Credit rating	
AA – A	Investment grade
B – C	Speculative grade
D – H	High risk of default

Thus, from the combination of the two variables obtained (nature of the activities and quality of the sectoral portfolio) it is possible to establish the relevance at sectoral level, which can also be low, medium or high, as shown in the image below:



To illustrate the application of the tool in its various steps and layers, this guide will follow the example of Bank A, a hypothetical institution that belongs to the BCB S3 segmentation and has a credit portfolio in the amount of R$ 9 billion.

Important: The economic sector must be understood as a CNAE Division.

Example 1. Identifying relevance on economic sectors (LAYER 1)

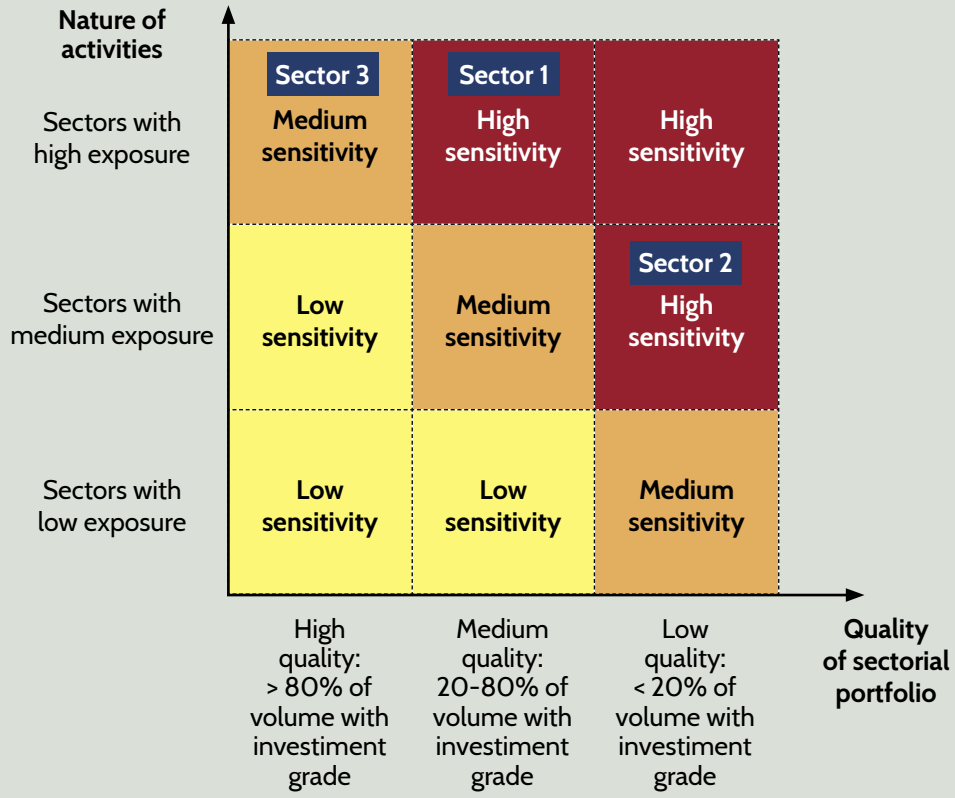
Bank A wants to identify the relevance of climate risk to its credit portfolio in three sectors: chemical products manufacturing, textile manufacturing and motor vehicle manufacturing.

In order to identify sectorial relevance, it is first necessary to evaluate the **nature of the activities** of each sector, classifying them as low, medium or high exposure to climate risk according to the correspondence between the high and medium sectors of the TCFD and the CNAE Divisions.

Next, the bank should identify the **quality of the portfolio** of each sector based on the amount of investment grade operations present in these portfolios. Therefore, we have that Bank A has:

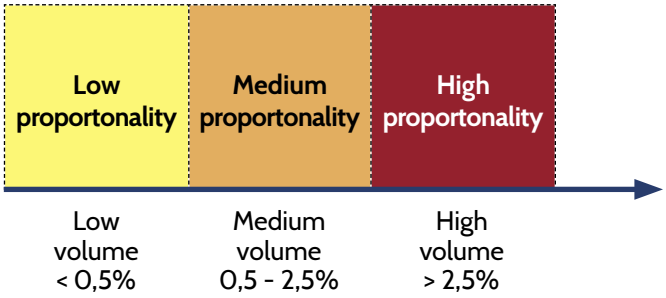
SECTOR	NATURE OF ACTIVITIES		SECTOR'S PORTFOLIO QUALITY	
1	Chemical products manufacturing	SECTOR WITH HIGH EXPOSURE	29% with investment grade	MEDIUM QUALITY: 20-80% OF AMOUNT WITH INVESTMENT GRADE
2	Textiles manufacturing	SECTOR WITH MEDIUM EXPOSURE	15% with investment grade	LOW QUALITY: <20% OF AMOUNT WITH INVESTMENT GRADE
3	Motor vehicle manufacturing	SECTOR WITH HIGH EXPOSURE	85% with investment grade	HIGH QUALITY: >80% OF AMOUNT WITH INVESTMENT GRADE

Then we have the two necessary variables to establish the relevance on sectors. This way, we should apply the relevance tool:



Proportionality on economic sectors

The second step of sensitivity assessment at the sector level is defined by the identification of proportionality, composed of only one variable: **the amount of the active credit portfolio in the economic sector**. The greater the portfolio of a given sector in relation to the total credit portfolio, the greater representativeness that the climate risk brings to the portfolio. The volume groups were classified as low, medium and high, according to the parameters of the proportionality system at the following sectoral level:

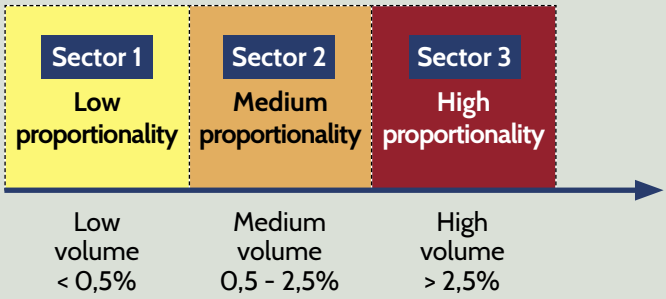


Example 2. Identifying proportionality on economic sectors (LAYER 1)

To complete the analysis of sensibility of the first layer, bank A identifies that its portfolios are representative comparing it to its total active credit portfolio, as in the table below:

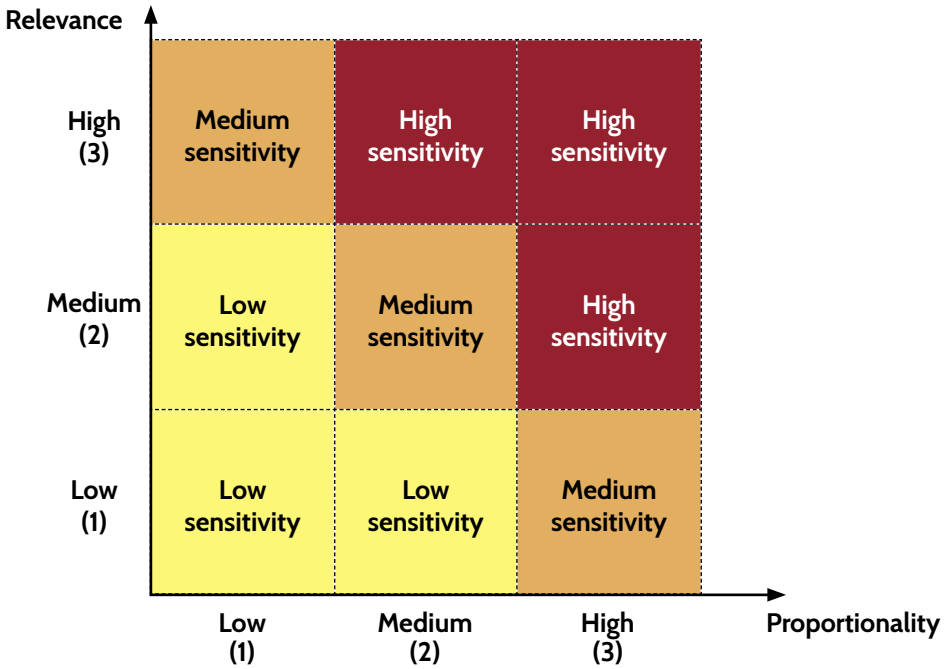
SECTOR	PROPORTIONALITY	
1	0.4%	LOW VOLUME < 0,5%
2	1.6%	MEDIUM VOLUME 0,5 – 2,5%
3	2.8%	HIGH VOLUME > 2,5%

Thus, it is observed that the proportionality on the sectorial level can be classified as:



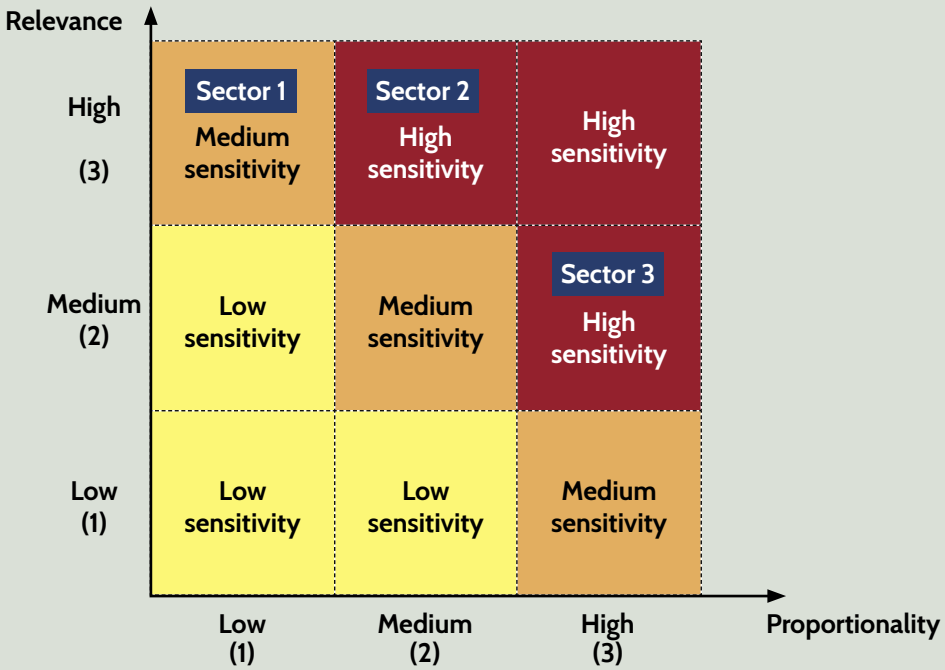
Results on economic sectors

To obtain sensitivity at the sectoral level, one should apply the results of the two steps mentioned above to the tool. For this, we must combine the results identified in each variable.



Example 3. Identifying sensitivity on economic sectors (LAYER 1)

Finally bank A applies the obtained result on the steps of relevance and proportionality sectors, this way obtaining the sensitivity on the economic sector. Thus achieving the following results:



By applying the tool on sectors for all the sectoral portfolios of a bank, it is possible to identify the level of sensitivity of the total credit portfolio. This analysis does not require a great deal of detail and allows the bank to generally identify the most sensitive sectors and the reasons that contribute to the sensitivity of its credit portfolio.

In order to identify the sensitivity of the total portfolio based on the combination of the sensitivities of the sector portfolios, you only need to identify the percentages of the active credit portfolio allocated in **high**, **medium** e **low** sensitivity sectors, according to the following parameters:

Percentages on the active credit portfolio[4]	Portifolio's sensitivity
High sensitivity ≥30%	**HIGH**
High sensitivity <30% and medium sensitivity ≥70% High sensitivity <30% E High sensitivity + Medium sensitivity ≥70%	**MEDIUM**
High sensitivity < 30% E High sensitivity < 70% E High sensitivity + Medium sensitivity < 70%	**LOW**

In addition, the credit portfolio sensitivity result can be used to guide the banks' response to TCFD disclosure demands as it provides input for **materiality evaluation** for the Recommended Disclosures database by TCFD.

Therefore, banks that have a **high sensitivity** diagnosis on climate risk on their credit portfolio should comply with all Recommended Disclosures, indicate maturity and continuous improvement process, providing detailed information in all Guidance items.

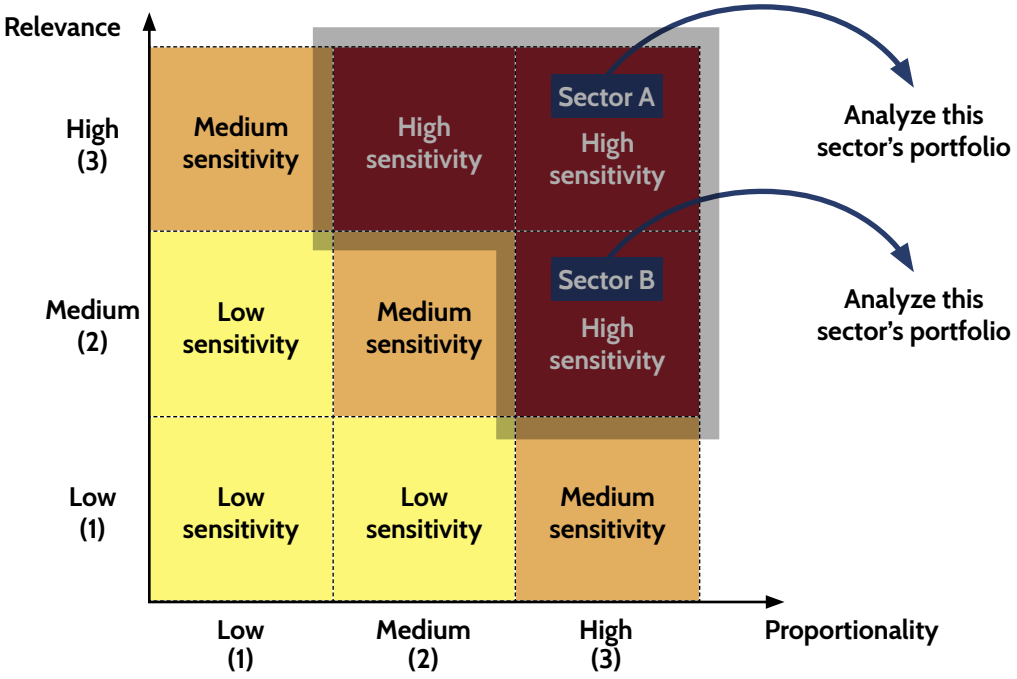
[4] Percentage classification defined based on discussions in the FEBRABAN TCFD / FSB Climate Risks Working Group.

For banks with **medium sensitivity**, they are expected to comply with all the Recommended Disclosures, which indicate maturity and process of continuous improvement in the more material Guidance items, providing a minimum of information for the others.

Finally, for banks that obtain **low sensitivity** on climate risk on their credit portfolio, they are expected to comply with the more material Recommended Disclosures using the Guidance items as a support to define which are the most important.

However, it is important to emphasize that the TCFD proposes that all the Recommended Disclosures of Governance and Risk Management be always met, **regardless of the materiality analyzes**.

Once the sensitivity analysis of the first layer is completed, the bank must decide whether or not to move to the next layer of the climate risk sensitivity analysis on clients. More sophisticated and granular, the second layer analysis is recommended for the higher sensitivity sectors identified in the first layer.



Application of the Tool on clients – LAYER 2

The application of the tool in the second layer allows the assessment of the clients of the institution belonging to the most sensitive sectoral portfolios. This analysis is useful because the exposure of a financial institution to climate risk is determined not only by the sector of the operations supported but also by other elements, such as the individual climate risk of the bank's clients, influenced by idiosyncratic issues.

Relevance on clients

The level of relevance on clients will be identified by analyzing the nature of the clients' activities and their credit rating.

VARIABLE	RATIONALE
1. Nature of clients' activities	The nature of the activities may be high, medium or low exposure to climate risks. In 2017 TCFD defined a list of sectors with the greatest exposure to climate risks, considering energy consumption, greenhouse gas (GHG) emissions and typical water consumption of the activities in these sectors. In addition to these, we propose in this tool the classification of some other sectors as medium exposure, considering water consumption, energy consumption, GHG emission and direct dependence of high exposure sectors. All other sectors that do not fall under any of the two categories above are considered as low exposure. For all these sectors, a correspondence was made with the CNAE Divisions, typically used by banks to classify their credit operations.
2. Credit rating	The client's credit rating, in general, can be classified as investment level, speculative level or high risk of default. The worse the rating, the lower the financial capacity of the client to respond to the potential impacts of climate risk, and the greater the risk of losses to the bank.

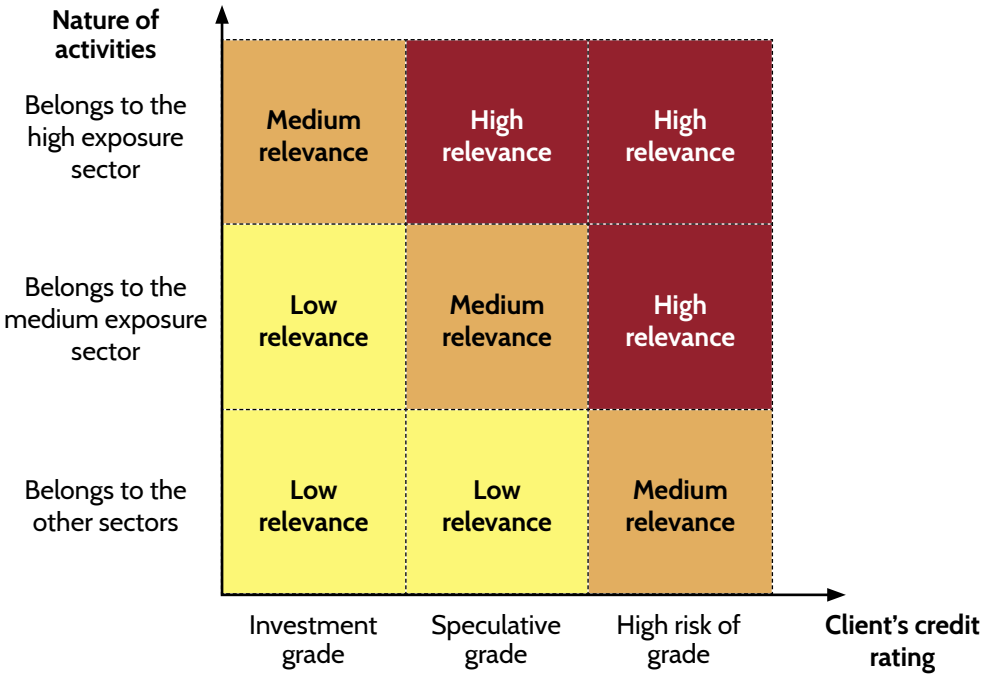
Thus, the first variable to be considered to identify relevance in the second layer is the nature of the clients' activities.

The activities will be classified according to the same scale presented in the analysis of relevance on sectors, according to the correspondence between the CNAE Divisions and the activities classified as **high**, medium or low exposure. The institution shall identify the CNAE Division in which the client is located, based on its CNPJ and verify the level of exposure of the Division according to the relationship presented above.

The second variable related to the principle of relevance that should be considered in the second layer of the sensitivity analysis is the client's credit rating, which can be classified as investment level, speculative level and high risk of default. The rating should be considered as inversely proportional to the relevance of the climate risks to the client, so that the lower the rating the greater the exposure. This is because clients with low ratings are less able to respond to the impacts of climate risk, so they are more likely to incur financial losses.

Client Credit Rating	
AA – A	Investment grade
B – C	Speculative grade
D – H	High risk of default

Therefore, the identification of clients relevance is given by the relationship between the nature of the clients' activities and the client's credit rating, as presented in the following relevance tool:



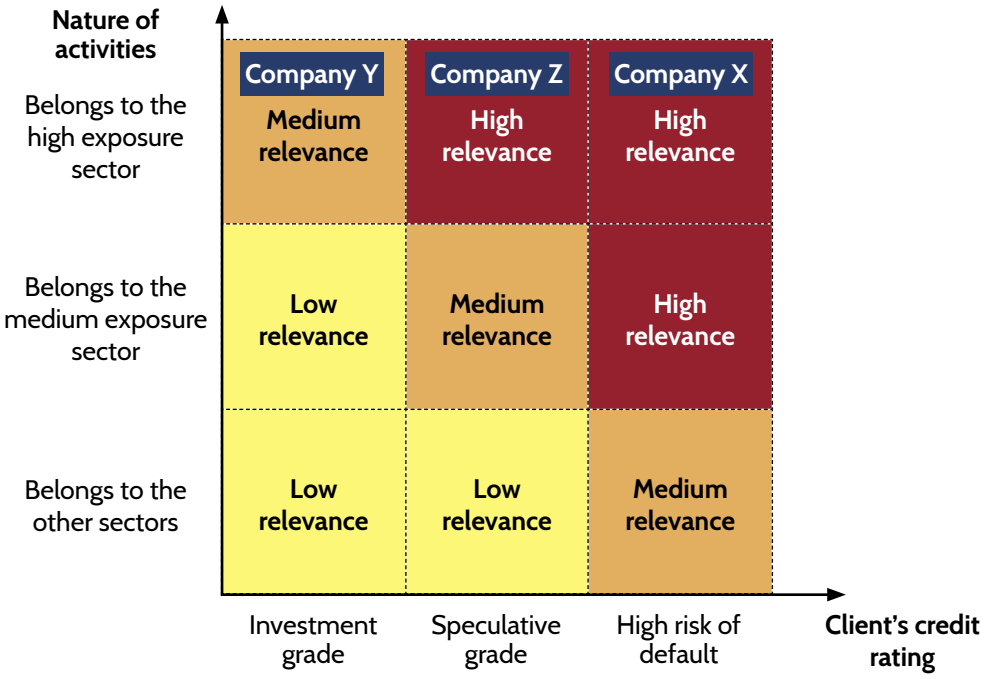
Example 4. Identifying the relevance on clients (LAYER 2)

After identifying that its sectoral portfolio of motor vehicle manufacturing is highly sensitive to climate risk, Bank A decided to deepen the analysis and apply the sensitivity rule in the second layer to the sector, composed of three clients:

CLIENT	NATURE OF ACTIVITIES		CLIENT CREDIT RATING	
COMPANY X	Motor vehicle manufacturing (...)	HIGH	D	HIGH DEFAULT RISK
COMPANY Y	Motor vehicle manufacturing (...)	HIGH	AA	INVESTMENT GRADE
COMPANY Z	Motor vehicle manufacturing (...)	HIGH	B	SPECULATIVE GRADE

The first step to perform the sensitivity analysis in this layer is to identify the relevance, compounded by the relationship between the nature of the activities and the client's credit rating. All companies belong to the same industry, with high exposure to climate risk. At the same time it is identified that the rating of company X is low, that of company Y is high and that of company Z is medium.

With the two variables identified for the three companies that compose the high exposure sector, the bank can evaluate the relevance of each one.



Proportionality on clients

The second step of the sensitivity assessment in the second layer is formed by the identification of proportionality at this level, which occurs through the evaluation of two variables: the weighted average term of operations with the client and the exposure of the financial institution to it.

VARIABLE	RATIONALE
1. Client's weighted average term	The client's weighted average term can be classified as ≥60 months, 24-60 months or <24 months. The client's weighted average term is calculated by the average of the terms of its operations, weighted by its amounts. The longer is the term, the greater the complexity that this climate risk offers the portfolio, for two reasons: the horizon for risk materialization is greater and the bank will be exposed more time to this client.
2. Exposure by client	Exposure by client can be classified as> 5% of Regulatory Capital (Patrimônio de Referência - PR), 1-5% of Regulatory Capital or <1% of Regulatory Capital.[5] The greater the portfolio of a given client in relation to the total credit portfolio, the greater the representativeness that the climate risk brings to the portfolio.

The first variable of proportionality to be considered is the weighted average term. The institution should perform the calculation as detailed in the table above for all clients of high sensitivity sectoral portfolio identified in the first layer.

The results obtained with the calculation should be categorized as follows:

Weighted average term
≥60 months
24-60 months
<24 months

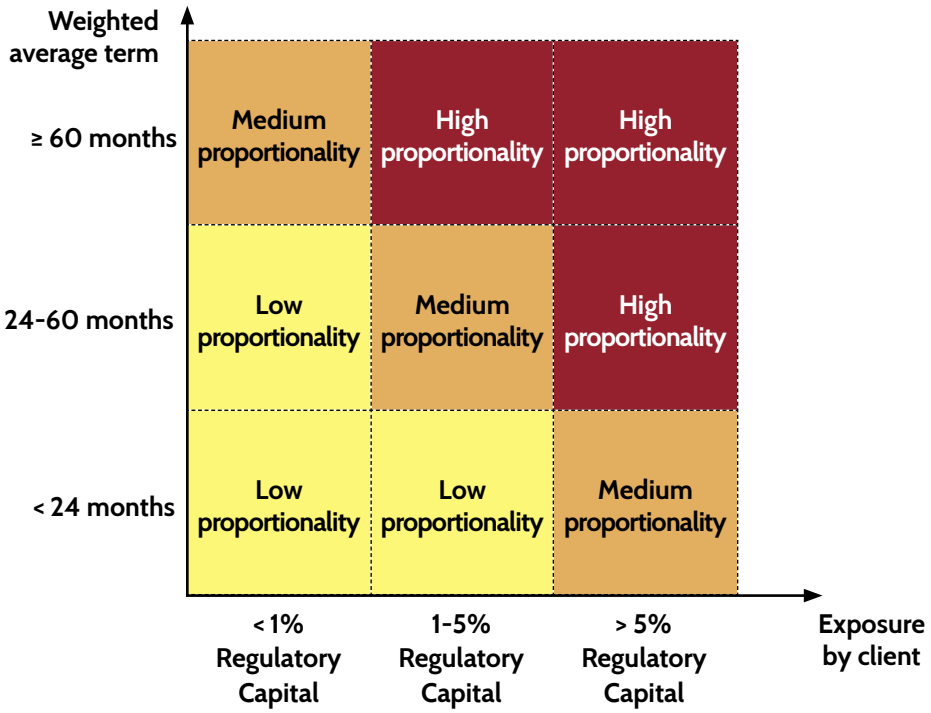
The second variable related to the principle of proportionality that should be considered in layer 2 of the sensitivity analysis is the exposure of the financial institution to the client, or the representativeness of its portfolio against the Bank's Regulatory Capital. The exposure by client is categorized according to the parameters below:

Exposure by client
>5% of Regulatory Capital
1-5% of Regulatory Capital
<1% of Regulatory Capital

[5] Banks can define their exposures based on assumptions that are compatible with their own risk management and capital management policies.

The definition of high, medium and low amount exposure bands was established taking as reference CMN Resolution 2,844/2001, which defines as "high concentration" the exposure by client that represents 10% or more of Regulatory Capital. In this tool, we opted for a more conservative approach.

Thus, the analysis of proportionality on clients is given by the relationship between the two variables mentioned above, returning a low, medium or high proportionality according to the image below:



Example 5. Identifying the proportionality on clients (LAYER 2)

After finding clients' relevance, bank A follows to analyze proportionality in the second layer by assessing the weighted average term of the portfolios and their exposure to each client. Thus, assuming that each client has two operations each, the bank observes the following information:

CLIENT	OPERATIONS TENOR	OPERATIONS AMOUNT
COMPANY X	12 months	R$ 7 MM
	60 months	R$ 29 MM
COMPANY Y	12 months	R$ 88 MM
	8 months	R$ 59 MM
COMPANY Z	60 months	R$ 69 MM
	120 months	R$ 187 MM

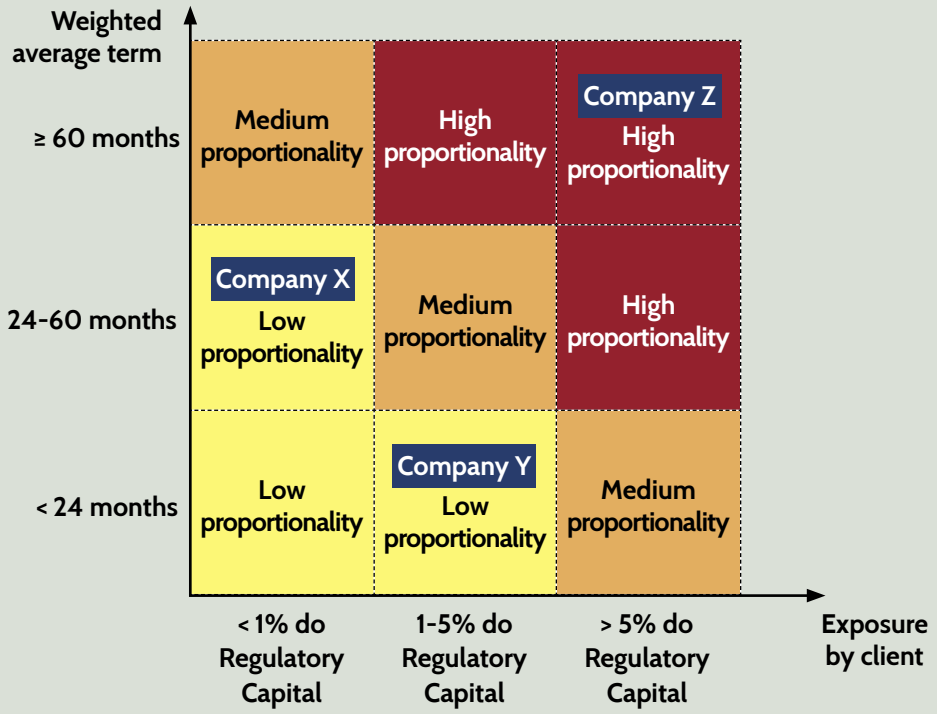
From these data, the bank calculates the weighted average term of the clients by multiplying the term of the operations by their respective amounts and dividing the result by the sum of the amounts of the client's operations. For company X the calculation is done as follows:

$$\text{Weighted average term} = \frac{(12 \times R\$\ 7\ MM + 60 \times R\$\ 29\ MM)}{(R\$\ 7\ MM + R\$\ 29\ MM)}$$

Carrying out this calculation for all companies and then identifying the exposure to each client, that is, the representativeness of their portfolio in relation to the bank's Regulatory Capital, it is observed that:

CLIENT	Weighted average term		Exposure by client	
COMPANY X	50 months	24-60 MONTHS	0.8%	< 1% OF RE
COMPANY Y	10 months	< 24 MONTHS	3.4%	1-5% OF RE
COMPANY Z	104 months	≥ 60 MONTHS	5.9%	> 5% OF RE

With the two variables identified, the bank can now calculate the proportionality on clients for each company analyzed:



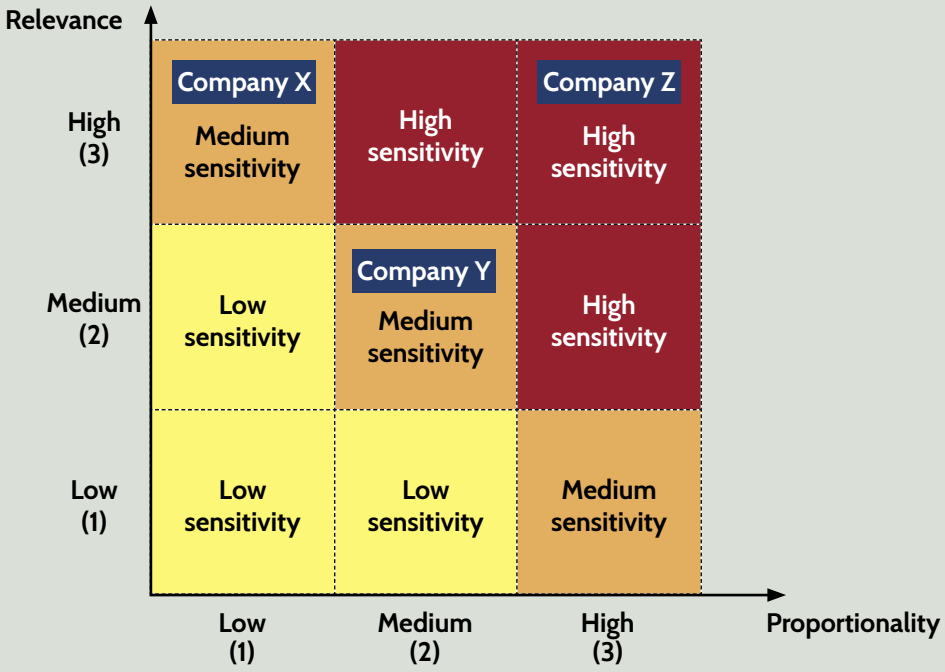
Results on clients

When obtaining the results of the two steps mentioned above, the tool must be analyzed again to obtain the result on clients.

The sensitivity result on clients that compose the sectorial portfolio of greater sensitivity to climate risk, obtained from the assessment of the variables of relevance and proportionality defined for this layer, allows the identification of the clients which should be prioritized in the management of climate risks and the reasons that contribute to the greater sensitivity of the sector portfolio (e.g. high exposures to a few critical clients).

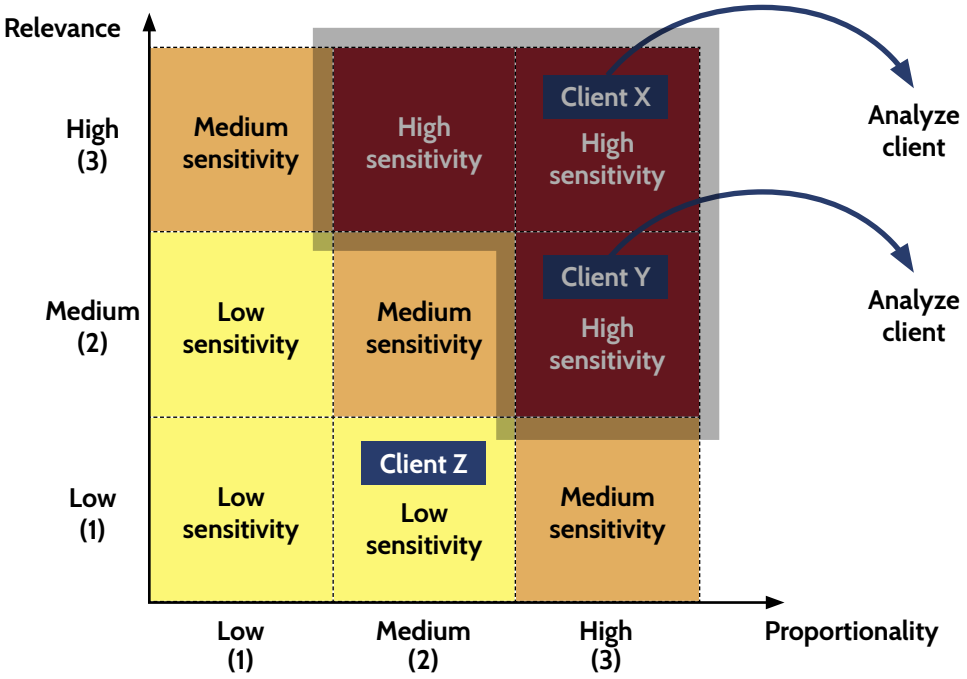
Example 6. Identifying sensitivity on clients (LAYER 2)

Bank A then applies the result obtained in the steps of identifying the relevance and proportionality in layer 2, in order to find the sensitivity of the clients at this level.



Therefore, the bank identified that one client has high sensitivity to climate risk, one has medium sensitivity and the other has low. Bank A also observes that Company Z is explained by the high exposure on its sector (relevance variable) and by its high complexity on the portfolio's weighted average term (proportionality variable).

Finally, after identifying the sensitivity on clients, the bank should once again decide whether to deepen the analysis and reach the level of the third layer, which analyzes the sensitivity to climate risk with detailed on operations. It is recommended that third layer analysis be applied to the most sensitive clients identified in the previous step.



Application of the Tool on operations – LAYER 3

In the third and last layer, the more granular, the application of the tool will allow the sensitivity assessment in the level of the operations of the clients more sensitive to the climate risk. This analysis promotes the identification of the operations to be prioritized in climate risk management, the reasons that contribute to the greater sensitivity of the analyzed clients and can be used to identify adjustment needs in the process of granting and monitoring credit operations.

The variables of relevance and proportionality that should be analyzed in each step are detailed in the table below:

RELEVANCE	PROPORTIONALITY
1. Nature of Activities 2. Operation Rating 3. Locational climate risk	1. Operation Tenor 2. Operation Amount

Relevance on operations

In order to determine the level of exposure to climate risk of the operations that make up the portfolios of highly sensitive clients, it is necessary to evaluate the nature of the activities financed by these operations, their ratings and the climate risk related to the location of the regions of the activities supported. These variables are explained in the following table:

Variable	Rationale
1. Nature of Activities	The nature of the activities may be high, medium or low exposure to climate risks. In 2017 TCFD defined a list of sectors with the greatest exposure to climate risks, considering energy consumption, greenhouse gas (GHG) emissions and typical water consumption of the activities in these sectors. In addition to these, we propose in this tool the classification of some other sectors as medium exposure, considering water consumption, energy consumption, GHG emission and direct dependence of high exposure sectors. All other sectors that do not fall under any of the two categories above are considered as low exposure. For all these sectors, a correspondence was made with the CNAE Divisions, typically used by banks to classify their credit operations.
2. Rating of the credit operation	The credit rating of the operations can be classified as AA - A, B - C or D - H. The worse the rating, the more exposed the operation will be to the potential impacts of climate risk and the greater the risk of them becoming losses for the bank.
3. Locational climate risk	Locational climatic risk can be classified as high, medium or low locational risk. Different locations are exposed to different levels of physical climate risks (e.g. water scarcity, storms, heat waves). Thus, one must identify whether the client's productive units are located in areas of greater or lesser physical risk. This version of the Guide is not intended to standardize the use of locational risk identification tools. Each tool has a type of risk classification, which can be linked to the classification of three groups adopted here (high, medium or low) for the local risk, according to the internal understanding of the banks' teams.

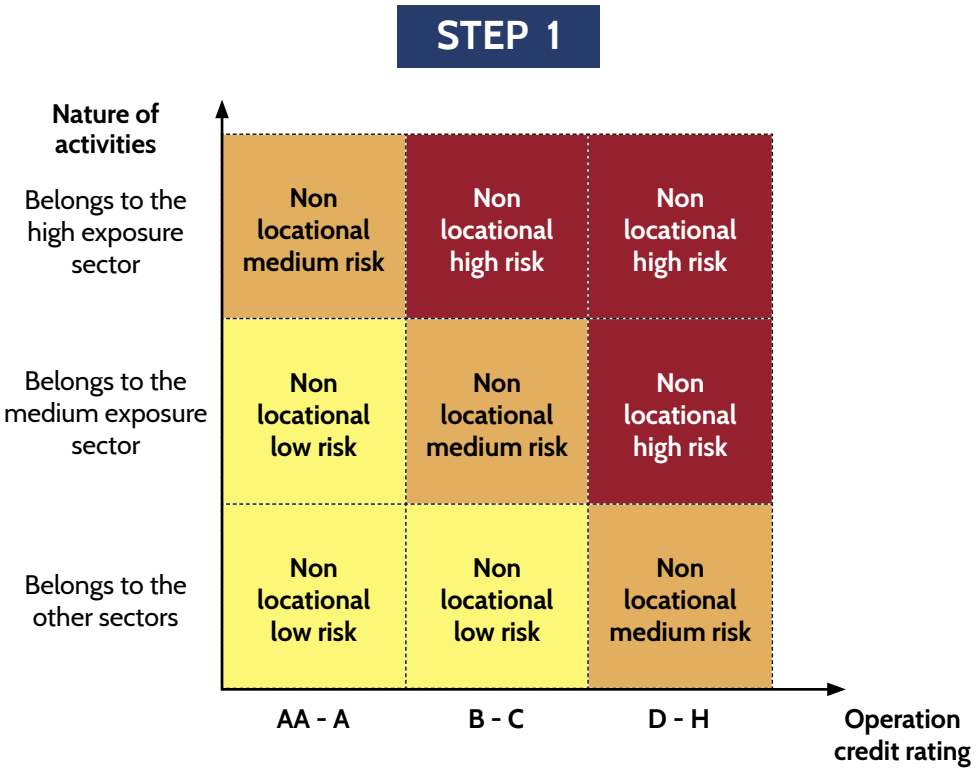
In this layer relevance must be calculated in two steps. In the first step two variables should be considered: the nature of the activities and the credit rating of the operation.

The nature of the activities will be classified according to the same scale presented in Layers 1 and 2, according to the correspondence between the CNAE Divisions and the activities classified as **high**, medium or low exposure. The institution shall identify the CNAE Division of the operation financed and verify its level of exposure to climate risk.

The credit rating of the operation will be categorized into three levels of exposure, in ascending order of risk and in line with CMN Resolution 2682/99:

Operation credit Rating
AA – A
B – C
D – H

Thus, the first step of identification of relevance on operations is given by the assessment of the relationship between the two variables mentioned above, returning a low, medium or high relevance according to the image below:



The result obtained from the relationship between the two variables described above will provide a new variable, called non locational risk, which can be classified as low, medium and high exposure. To identify the relevance in Layer 3, this resulting variable will be used in the second identification step in conjunction with the locational climate risk variable.

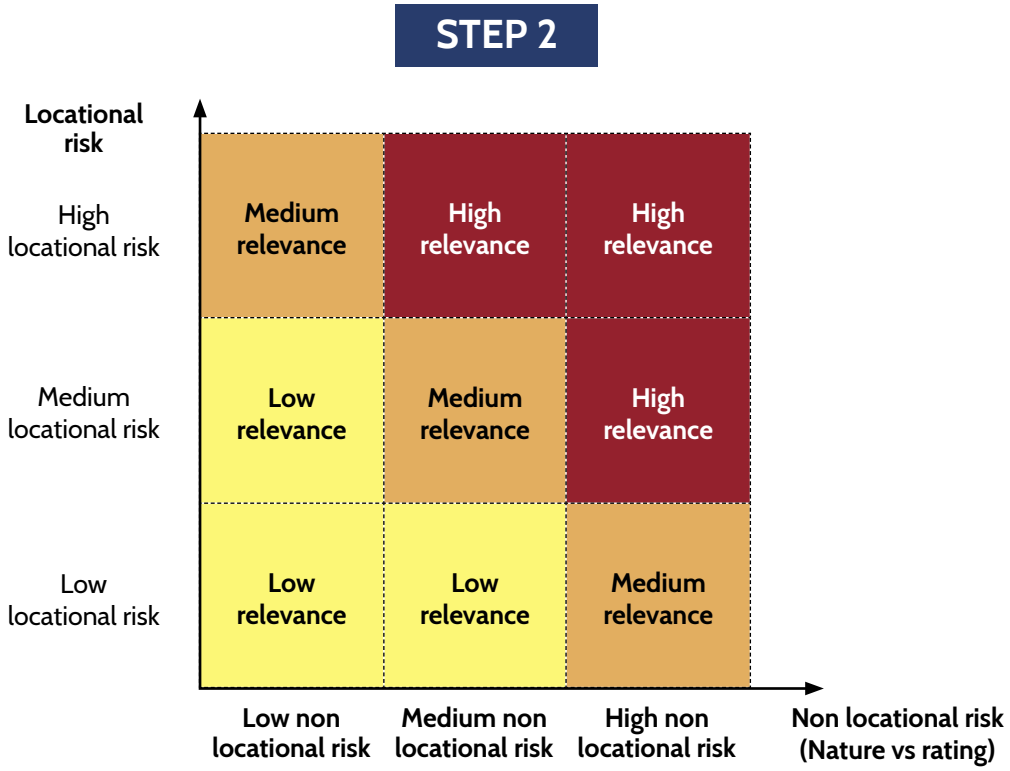
Locational climate risk may also be classified as low, medium or high and should be assessed according to the exposure related to the location of the production units of the most sensitive clients. For this variable to be identified, it is necessary for the bank to know these regions and the climate risks to which they are exposed. The first information, related to location, if it is no longer demanded of the clients by the bank, should be requested, whereas for the second, regarding climate risks by region, there are options of free and paid tools online.

Some suggestions for free tools are listed in the following table:

Tool	Description
Think Hazard	Map informing the natural disasters to which an area is exposed, with descriptions of the potential impacts http://thinkhazard.org/en/
WRI Aqueduct Atlas	Map indicating current and forecast scenarios for 2020, 2030,2040 water risks (by type), by location. https://www.wri.org/ourwork/ project/aqueduct
WWF Water Risk	Map indicating current water risks (by type) http://waterriskfilter.panda.org/pt

Therefore, in order to assign the locational climate risk, the bank must identify which productive units of the client are associated with the analyzed credit operation. If there is more than one (i.e. a corporate risk operation), it is suggested that the bank: (i) assign to the operation the highest level of locational risk between identified units; or (ii) make a weighted average of the levels of locational risk of the units identified, considering the representativeness of each unit.

Thus, the second step of evaluating the relevance on operations is given by the evaluation of the relationship between the locational risk and the non-locational risk, and returns with a low, medium or high relevance according the image below:



Example 7. Identifying the relevance on operations (LAYER 3)

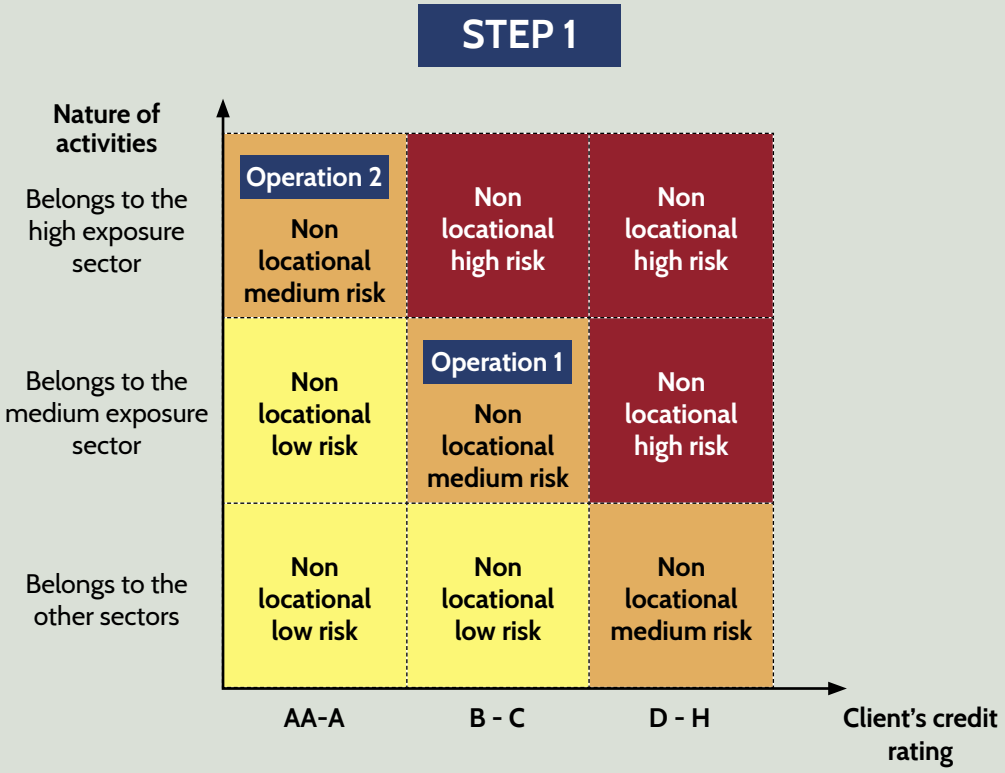
After identifying the sensitivity on clients that compose the sectoral portfolio of motor vehicles manufacturing, bank A decided to further deepen the analysis and apply the tool in the third layer to the most sensitive client, company Z.

The first step to perform the sensitivity analysis in this layer is to identify the relevance in two steps: (1) Evaluation of the relationship between the nature of the activities and the credit rating of the operations; (2) Evaluation of the relationship between non-local risk and local risk.

Therefore, the bank collects the information necessary for the first step of evaluating the relevance of the Company Z's operations:

OPERATION	NATURE OF ACTIVITIES		CREDIT OPERATION RATING	
1	Motor vehicles manufacturing	BELONGS TO THE SECTOR WITH HIGH EXPOSURE	A	AA - A
2	Motor vehicles manufacturing	BELONGS TO THE SECTOR WITH HIGH EXPOSURE	B	B - C

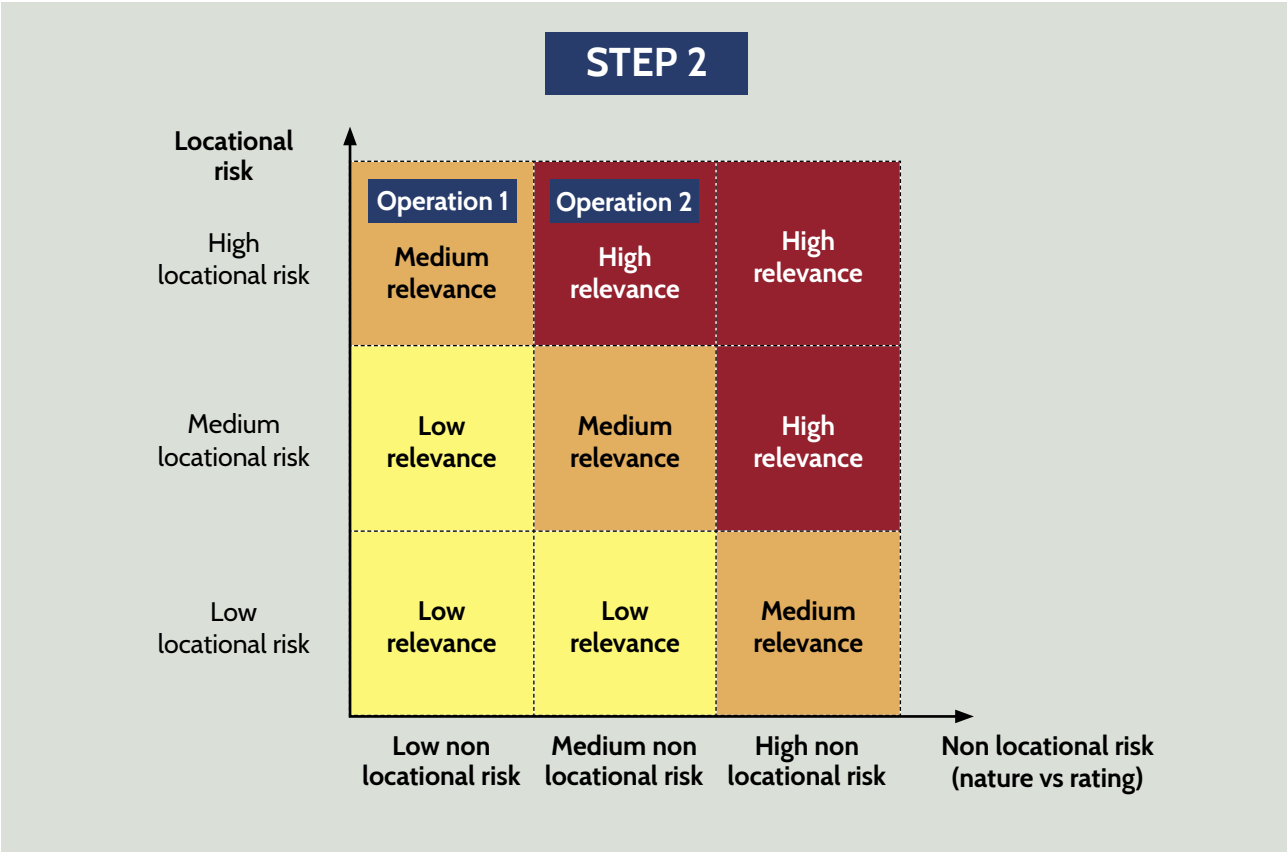
From this variables relation analysis above, the bank identifies the non-locational risk on operations on Company Z.



Next, the bank starts the second step to identify the relevance on operations, gathering information about non locational risk and locational risk of the two companies and its operations, using the Aqueduct tool.

OPERATION	NON-LOCATIONAL RISK (NATURE vs RATING)	LOCATIONAL RISK	
1	MEDIUM NON LOCATIONAL RISK	Medium to high (Aqueduct)	MEDIUM LOCATIONAL RISK
2	HIGH NON LOCATIONAL RISK	Medium to low (Aqueduct)	LOW LOCATIONAL RISK

Then it identifies the relevance on operations.



Proportionality on credit operations

The second step for the analysis of sensitivity on operations is the identification of proportionality, which occurs through the evaluation of the relationship between two variables: the term and amount of the operation.

VARIABLE	RATIONALE
1. Operation Tenor	The term of the operation can be classified as ≥60 months, 24-60 months or <24 months. The longer the term of the operation, the greater the complexity that this climate risk offers to the portfolio, for two reasons: the horizon for risk materialization is greater and the bank will be exposed to this operation more time
1. Operation Amount	The amount of the operation can be classified as high, medium or low amount. The greater the amount of the operation, the greater the representativeness that the climate risk brings to the portfolio.

The first proportionality variable to be considered is the term of the operation.

Operation Term
≥60 months
24-60 months
<24 months

The second variable to be considered in the proportionality analysis on operations is the amount of the operation, which can be classified as high, medium or low according to the following parameters:

BCB Segments	Amount		
	HIGH AMOUNT	MEDIUM AMOUNT	LOW AMOUNT
S1	> 35 MM	10 – 35 MM	< 10 MM
S2	> 7 MM	2 – 7 MM	< 2 MM
S3	> 1.4 MM	0.4 – 1.4 MM	< 0.4 MM
S4	> 0.28 MM	0.08 – 0.28 MM	< 0.08 MM
S5	> 0.28 MM	0.08 – 0.28 MM	< 0.08 MM

Determination of proportionality groups in the second and third layers

The proportionality groups (high, medium or low) according to the amount of the operations were defined from the definition of minimum limits for high, medium and low amounts and the relativization of these limits according to the size of the bank.

To define the limits, the typical minimum amount required for operations to be handled with greater level of socio-environmental diligence was considered. In this sense, the Equator Principles require detailed socio-environmental analysis for project finance operations with an amount equal to or greater than US$ 10 million. This minimum amount is also used by other financial institutions to define which operations will pass through the highest level of diligence in the socio-environmental risk analysis.

For the climate risk sensitivity assessment tool, it was established that this value of US$ 10 million or R$ 35 million would be the minimum threshold for a larger bank operation (segment BCB S1) to be classified as **high** amount, which indicates greater proportionality of this operation. From this amount, the subsequent limits (R$ 10 million and R $ 3.5 million) were defined.

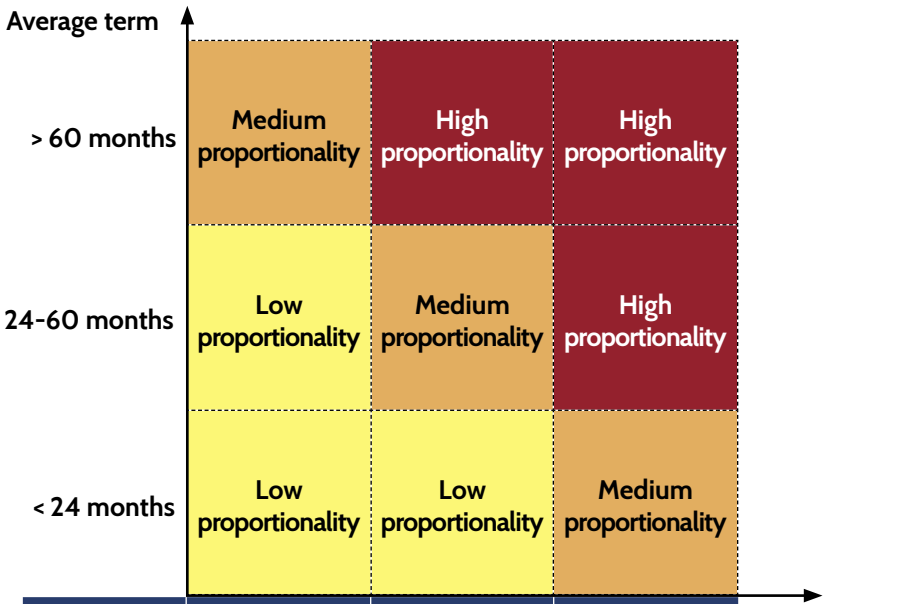
The weightening of the minimum limits defined according to the size of the bank was made from the consideration of the factor that establishes a ratio between different bank profiles. It was decided to use as a factor the definitions of CMN Resolution 4553/2017, which classifies the banks into different segments according to their size:

Segments	Relation between size and GDP	
S1	Size/GDP ≥ 10%	
S2	10% > Size/GDP ≥ 0.1%	+ 10
S3	1% > Size/GDP ≥ 0.1%	+ 10
S4	Size/GDP < 0.1%	+ 10
S5	Size/GDP < 0.1%	same value

From the ranges of values that define high, medium and low amounts for larger banks (S1), the bands for the other segments were established. To ease the proportional factor that separates the bearings from the banks (10), 5 was used as the ratio factor.

Segments	Groups for caracterization of operations volume			
	High	Medium	Low	
S1	> 35 mm	10 - 35 mm	< 10 mm	
S2	> 7 mm	2 - 7 mm	< 2 mm	+ 5
S3	> 1.4 mm	0.4 - 1.4 mm	< 0.4 mm	+ 5
S4	> 0.28 mm	0.08 - 0.28 mm	< 0.08 mm	+ 5
S5	> 0.28 mm	0.08 - 0.28 mm	< 0.08 mm	same value

Thus, the proportionality assessment on operations is given by the relationship between the two variables detailed above, returning a result that can vary between low, medium or high proportionality, as shown in the following image:



Segments BCB	Low volume	Medium volume	High volume
S1	< 10 MM	10 – 35 MM	> 35 MM
S2	< 2 MM	2 – 7 MM	> 7 MM
S3	< 0.4 MM	0.4 – 1.4 MM	> 1.4 MM
S4	< 0.08 MM	0.08–0.28 MM	> 0.28 MM
S5	< 0.08 MM	0.08–0.28 MM	> 0.28 MM

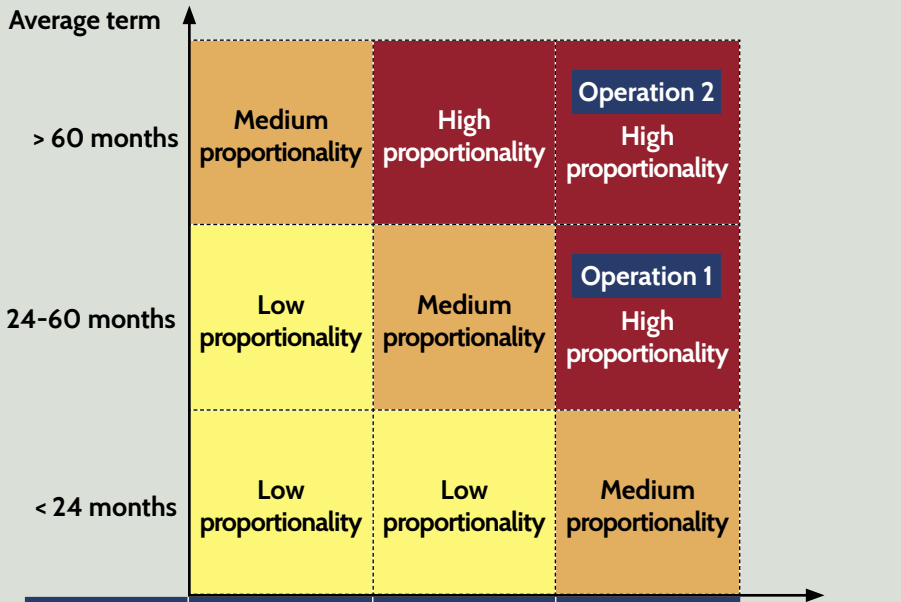
Example 8. Identifying the proportionality on credit operations (LAYER 3)

In order to identify the proportionality of the operations of the highly sensitive companies under analysis, Bank A needs to classify the exposure of the amount and the terms of its operations as low, medium or high, according to the parameters for its segment (S3).

Segments BCB	Low amount	Medium amount	High amount
S1	< 10 MM	10 – 35 MM	> 35 MM
S2	< 2 MM	2 – 7 MM	> 7 MM
S3	< 0.4 MM	0.4 – 1.4 MM	> 1.4 MM
S4	< 0.08 MM	0.08–0.28 MM	> 0.28 MM
S5	< 0.08 MM	0.08–0.28 MM	> 0.28 MM

Thus, bank A identifies:

OPERATION	AVERAGE TERM		AMOUNT	
1	60 months	24-60 MONTHS	R$ 69 MM	HIGH AMOUNT
2	120 months	> 60 MONTHS	R$ 187 MM	HIGH AMOUNT



Segments BCB	Low volume	Medium volume	High volume
S1	< 10 MM	10 – 35 MM	> 35 MM
S2	< 2 MM	2 – 7 MM	> 7 MM
S3	< 0.4 MM	0.4 – 1.4 MM	> 1.4 MM
S4	< 0.08 MM	0.08–0.28 MM	> 0.28 MM
S5	< 0.08 MM	0.08–0.28 MM	> 0.28 MM

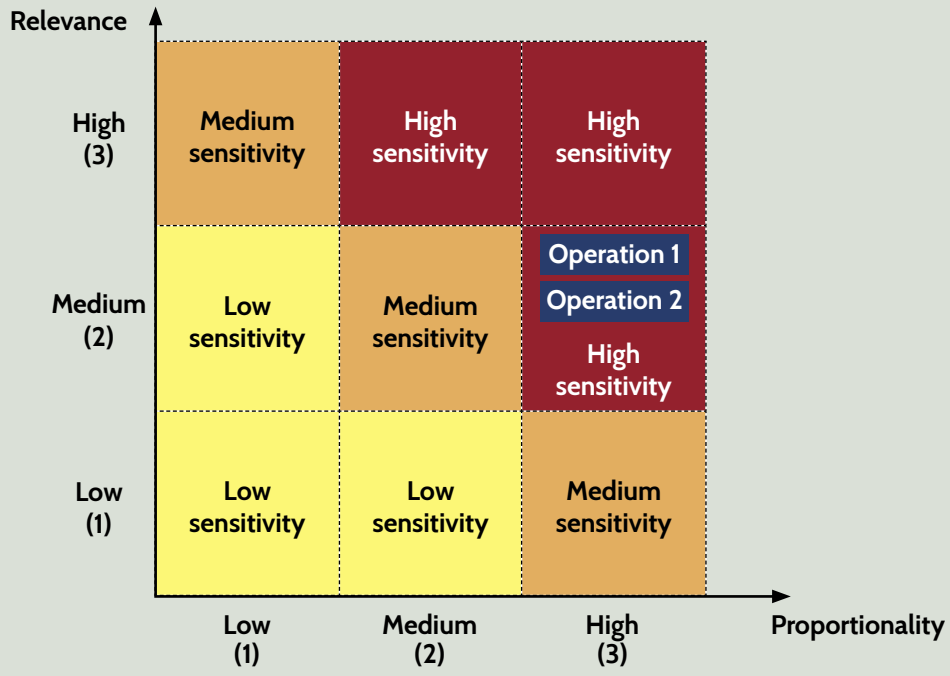
Results on credit operations

When obtained the results of relevance and proportionality on operations, you can re-analyze the sensitivity tool to obtain the final result of Layer 3.

Thus, the most sensitive operations on clients are identified. With this result, it is possible to identify the operations that should be prioritized in the context of climate risk management, the reasons that contribute to the greater sensitivity of the client and the adjustment needs in the process of granting and monitoring credit operations so that the bank knows the location of the clients' production units.

Example 9. Identifying sensitivity on credit operations (LAYER 3)

Finally, bank A applies the obtained result in the steps of identifying the relevance and Proportionality, in order to find the sensitivity on operations.



Appendix I – Sectors of high and medium climate risk exposure

SECTORS WITH HIGH EXPOSURE (TCFD)	Correspondent CNAE Divisions - NAME
Oil and gas	19 – Hull, petroleum products and biofuels manufacturing
	06 – Extraction of oil and natural gas
Coal	35 – Eletrictricity, gas and other utilities
Electric utilities	
Air freight	51 – Air freight
Passenger air transportation	52 – Storage and auxiliary transport activities
Marine transportation	50 – Marine freight
	52 - Storage and auxiliary transport activities
Rail transportation	49 – Ground transport
Trucking services	52 - Storage and auxiliary transport activities
Automobiles and components	29 – Motor vehicles, trailers and car body manufacturing
Metals and Mining	24 - Metallurgy
	05 – Extraction of mineral coal
	07 – Extraction of metallic minerals
	25 – Metal products manufacturing
	09 - Activities to support minerals extraction
Chemicals	20 – Chemicals manufacturing
Construction materials	08 – Extraction of nonmetallic minerals
	28 – Machinery and equipment manufacturing
Capital goods	28 - Machinery and equipment manufacturing
Real estate management and development	41 – Building construction
	42 - Infrastructure
	43 – Specialized construction services
	68 – Real estate activities
Beverages	11 – Beverages manufacturing

SECTORS WITH HIGH EXPOSURE (TCFD)	Correspondent CNAE Divisions - NAME
Agriculture	01 - Agriculture, livatock and related services c
Packaged food and Meats	10 – Food products manufacturing
Paper and forest products	02 – Forestry production
	16 – Wooden products manufacturing
	17 – Pulp, paper and paper products manufacturing

SECTORES WITH MEDIUM EXPOSURE	FACTORS
• Water collection, treatment and distribution (water utilities) • Other processing industries not included as high exposure by TCFD	Energy consumption
	Water consumption
	GHG Emission
• Finance services • Insurance	High dependence on high exposure sectors

SECTORES WITH MEDIUM EXPOSURE	Correspondent CNAE Divisions - NAME
Other processing industries not included as high exposure by TCFD	12 - Tobacco products manufacturing
	13 – Textiles manufacturing
	14 - Apparel and accessories manufacturing
	15 - Leather preparation and leather goods manufacturing, travel goods and footwear
	21 - Pharmaceutical and pharmachemical products manufacturing
	22 - Rubber and plastic products manufacturing
	23 - Non-metallic mineral products manufacturing
	26 - Computer, electronic and optical products manufacturing
	27 - Electrical machinery, apparatus and equipment manufacturing
	30 - Other transport equipment manufacturing, except motor vehicles
	31 – Furniture manufacturing
	33 - Maintenance, repair and installation of machinery and equipment
Water utilities	36 - Collection, treatment and distribution of water
Finance services	64 - Financial Services Activities
Insurance	65 - Insurance, Reinsurance, Complementary Pension Plans and Health Plans

Appendix II – Tool Limitations

Despite the benefits of applying the tool to the banks and the flexibility to be applied by different institutions and in different layers, the tool has some limitations, which do not harm its objectives.

Ruler positive features	Limitations
Applicable to different bank profiles	The second and third layers may require the definition of some premises or adaptations for banks with very particular portfolios (e.g. banks associated with an economic group).
Conceived as a prioritization tool, to be used at the tactical-strategic leve	The tool should not be used on operations for decision-making to grant credit. For this, other tools and processes, such as the incorporation of climate risk into the credit rating should be used.
It allows banks to apply it (in at least one of the layers) without the need to capture additional information from their operations, develop new processes or create tools	The tool can be refined in a continuous development path of the bank in the processes of climate risk management, with the incorporation of new variables or adjustments in the calculation methods.

In addition, the following specific limitations in the application of the tool should be considered:

1. The tool assesses the sensitivity of only corporate credit operations, the main activity of the banking sector. Other forms of action (e.g. financial advisory) may also expose the bank to climate risk but on a smaller scale. Banks can qualitatively assess how these other forms of action contribute to increasing their sensitivity to climate risk.

2. There are cases of clients that operate in more than one economic sector and this information is not captured in the banks' systems. For these cases, banks should assess whether it is desirable to divide the amount of credit of a specific client or act in more than one sector.

3. Clients and credit operations:

a. The assignment of the client's credit rating and of the operations is subject to certain discretion, according to the evaluation processes of each bank.

b. The tool does not capture how clients manage their exposure to climate risk, which can reduce to the bank, the clients exposure and operation.

4. Credit Operations:

a. For retail operations, a rating is typically not established. If the bank wishes to consider this type of transaction in this assessment layer, it is suggested that the client's rating be used as a reference.

b. In some cases, the location of the productive units is less important than the location of the productive units in their value chain (e.g. agricultural trading). In these cases, it is recommended that the bank adapt this third layer of the tool.

c. Although the locational aspect is more strongly associated with physical risk, there are also transition risks that depend on the locality. These risks must be captured in socio-environmental risk analysis.

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