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Developing a Sustainability Credit Score System

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Abstract Within the banking community, the argument about sustainability and profitability tends to be inversely related. Our research suggests this does not need to be strictly the case. We present a credit score system based on sustainability issues, which is used as criteria to improve financial institutions' lending policies. The Sustainability Credit Score System (SCSS) is based on the analytic hierarchy process methodology. Its first implementation is on the agricultural industry in Brazil. Three different firm development paths are identified: business as usual, sustainable business, and future sustainable business. The following six dimensions are present in the SCSS: economic growth, environmental protection, social progress, socio-economic development, eco-efficiency, and socio-environmental development. The results suggest that sustainability is not inversely related to profit either from a short- or long-term perspective. The SCSS is related to the Equator Principles, but its application is not driven to project financing. It also deals with short- and long-term risks and opportunities, instead of short-term sustainability impacts.

Keywords Sustainability · Risk management · Lending policies · Equator Principles · Banking industry · Management practices · Corporate social responsibility

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Introduction

The current trend in the literature on sustainability and finance is shifting from the idea that sustainability is a constraint on the profit function of firms toward a vision that financial markets can promote sustainability because of its many linkages with the rest of the economy. Scholtens (2006, 2009), for instance, argues that finance can promote socially and environmentally desirable activities through the credit channel and private equity activities. Adams and Frost (2008) find that companies are increasingly incorporating social and environmental KPIs into their strategic planning, but the issues raised by management and the way that they are integrated into operations vary considerably within their sample.

There are two major trends in the literature relating to sustainability and the banking industry: external and internal practices. The external practices strand analyzes the relevance of sustainability to the bank's communication with shareholders and other stakeholders, and how investors use it as a measure to help achieve optimal portfolio allocation (e.g., Herzel et al. 2012; Konar and Cohen 2001; Weber 2005; Wright 2012). The internal practices literature, more relevant to the present work, studies how sustainability criteria are integrated into risk management models and lending practices. Weber et al. (2008, 2010) use sustainability as a predictor of future financial performance and contend that banks should apply it in their credit risk models. Another example is Thoumy and Vachon (2012), who show the relevance of sustainability to project finance in Canada.

We focus, as do Singh et al. (2007), on the credit score as a decision tool for financial institutions and present a case study in which a multinational bank applies the methodology to the sugar and ethanol industry in Brazil. The main goal of this paper is to present a new way to incorporate sustainability into banking practices by focusing on a credit rating score system to improve financial institutions' lending policies.

Many banks now use the Equator Principles (EPs) as a framework for assessing environmental and social risks into project finance, but few integrate sustainability into more widespread credit products. In the present paper, we analyze the case of a multinational bank that creates a sustainability credit score (based on the AHP methodology) to be used in loans to the agricultural industry in Brazil. We find no evidence of a similar approach to determine reputational risk based on sustainability issues. We contribute to the literature by discussing the implications of voluntary sustainability practices in a commercial bank's lending practices. There is a growing literature on the relationship between regulation and sustainability in the banking industry; for instance, Richardson (2009) argues that regulation must target the financial sector because it profits from unsustainable practices. However, if there is an eco-premium (e.g., Lubin and Esty 2010), market mechanisms may complement regulation in integrating sustainability and management practices.

The Sustainability Credit Score System (SCSS) is developed through the following stages:

- Selecting the industry;
- Analyzing the industry: economic outlook, product life-cycle analysis, value chain, legislation and public policy, industry self-regulation, and innovation.
- Developing paths for the average firm: business as usual (BAU); sustainable business (SB); and future sustainable business (FSB).
- Defining variables related to individual firms, in each of six sustainability dimensions: economic growth (EG), environmental protection (EP), social progress (SP), socio-economic development (SD), eco-efficiency (EE), and socio-environmental development (SE).
- Unveiling the materiality issues pertaining to the average firm, plus vulnerabilities and opportunities regarding the sustainability of the industry.
- Combining the information on the steps above to obtain questions for the composition of the score system.
- Defining the weights for the analytical hierarchy process.

The final result is a credit score system that rates companies and is composed of six matrices for the six sustainability dimensions, each matrix $A_i = (a_{ij})_{1 \le i,j \le n}$, in which $a_{ij} = \begin{cases} 1 & \text{if } i = j \\ 1/a_{ji} & \text{if } i \neq j \end{cases}$, and a weighting matrix for the six dimensions.

For each dimension, A_i is composed of five questions, and a final questionnaire of 30 questions is developed from the analytical model, giving us a final sustainability credit score that ranges from 0 to 1 and is used as a tool to assess the sustainability of a company in the selected industry.

Incorporating Sustainability into Commercial Practices in the Banking Industry

The CSR literature can be divided into external and internal practices. External practices relate to mitigating corporate externalities and the value of reporting it to stakeholders. Internal practices and CSR relate to how management practices change regarding sustainability issues and is the subject of our research from both lender and borrower perspectives. Research suggests that CSR plays a role in financial institution strategies (Jeucken 2001; Jeucken and Bouma 2001). As a result, Weber (2005) divides financial institutions approaches to integrating sustainability into five models: event-related integration of sustainability, sustainability as a new banking strategy, sustainability as a value driver, sustainability as a public mission, and sustainability as a requirement of clients. His research contends that sustainability events usually prompt new management practices into the banking industry. Hu and Scholtens' (2012) analyze 402 banks from 44 developing countries and conclude that commercial banks in developing countries perform relatively well on social issues but are rather poor performers regarding environmental management, codes, and responsible products. Thus sustainability variables may provide incentives for financial institutions to develop new strategies such as the eco-premium (Lubin and Esty 2010), creating positive change in which companies conduct business (Conley and Williams 2011; San-Jose et al. 2011).

The CSR literature also suggests that CSR variables affect the cost of capital (Ghoul et al. 2011) and that lenders react positively to CSR practices. Goss and Roberts (2011) demonstrate that firms with social responsibility concerns pay between 7 and 18 basis points more than firms that are more responsible. However, this effect disappears for high quality borrowers. But Scholtens and Dam (2007) analyze banks using the EPs on projects over US$10 million and find different policies regarding social, ethical, and environmental issues from non-adopters. They conclude that adoption of the EPs is used to signal responsible conduct. Going further than the EPs, then, should also provide more signals of responsible conduct to the market.

The EPs are a risk management framework, adopted and managed by financial institutions, to determine, assess, and manage environmental and social risk in project finance. The EPs apply to four financial products: project finance advisory services, project finance, project-related corporate loans, and bridge loans. Thresholds are high: project capital costs should be US$10 million or more, and for project-related corporate loans; the total aggregate amount should be at least US$100 million. As of 2013, 78 financial institutions in 35 countries have officially adopted the EPs.

Financial institutions commit to implementing the EPs in their internal environmental and social policies, procedures, and standards for financing projects and should not provide project finance or project-related corporate loans to projects in which the client is unable to comply with the EPs.

Signaling theory (see Connelly et al. 2011) provides an explanation to added incentives for commercial banks to promote sustainable management practices, environmental management practices (Hofer et al. 2012), or CSR disclosure (Dhaliwal et al. 2011). Signaling theory is concerned with information asymmetry between senders and receivers. Reducing information asymmetry can generate competitive advantages by showing stakehold engagement on the part of firms. Sustainable management and participation in the EPs by financial institutions can emerge as a response to either sustainability as a value driver, an eco-premium, or signaling through enlightened self-interest (Pitelis 2013). All are constructs that are closely related theoretically and relevant to the present case. However, signaling theory is more related to external management practices, while the eco-premium and the sustainability as a value driver are closely related to internal management practices. We follow the latest, as the SCSS is developed for a multinational commercial bank to change its lending policies. While institutions adopt EPs as a signal to shareholders and stakeholders, the SCSS is a regular score system to determine the credit score of potential clients.

Our research is an offshoot of Chih et al. (2010) and Nandy and Lodh (2012). In the first, the authors investigate a total of 520 financial firms in 34 countries and find that larger firms are more CSR minded, even though financial performance and CSR are not related; firms act in more socially responsible ways to enhance their competitive advantages when the market competitiveness is more intense, and firms in countries with stronger shareholder rights tend to engage in fewer CSR activities. In the present case, the SCSS is developed for an institution that closely resembles the characteristics reported by Chih et al. (2010): it is a commercial bank in a country with weak shareholder rights, and it is a large institution that faces intense market competition. Hence, it is poised to have the proper incentives to develop innovative CSR policies. These policies should generate competitive advantage not only by reducing information asymmetry between the company and its stakeholders but by increasing profits related to its core business. In the case of commercial banks, lower probability of defaults (PDs) should be the result of introducing rating systems like the present SCSS.

Nandy and Lodh (2012) use 3,000 lending transactions by banks in the US and find that eco-friendly firms obtain more favorable loan contracts than firms with a lower environmental score. They argue that banks can reduce their default risk by considering firms' environment-consciousness when determining loan contracts. However, most models (e.g., Goss and Roberts 2011) usually assume that banks are socially neutral and are concerned solely with credit repayment.

The SCSS may reduce information asymmetry by engaging stakeholders, but its main purpose is to reduce banks risks by lowering default rates. Rating scales are commonly used in the financial industry [e.g., Grunert et al. (2005) and Duffie and Singleton (2012)]. We follow the standard approach for developing a credit score based on the analytic hierarchy process (AHP) methodology. There are always important issues related to the development of scale measures (Churchill and Peter 1984). Recent developments outline the desirable characteristics of scales (Sanjeev 2003). The SCSS is supposed to follow the desirable characteristics of Sanjeev (2003). However, it is still being implemented, and there is no data available to measure its reliability and validity. We come back to this issue in a later section, when we discuss the implementation of the SCSS.

Methodology for the Sustainability Credit Score System

Lending practices by commercial banks rely on credit score systems, developed to estimate risk against default by borrowers. New regulatory standards under the heading Basel III mean that banks need to estimate the loss parameters: probability of default, loss given default, and exposure at default. Usually banks rely on credit-worthness as the main criteria, and all information for the decision making is related to financial information or qualitative data on how likely is that borrowers can repay their loans.

In the present case, the SCSS would complement regular credit rating models by yielding qualitative and quantitative information that would lead to improved decision making. For example, let's assume that companies would be rated in the same way as in regular credit models, with sustainability worthiness ranging from triple A (prime borrowers) to D (default). Assume a company with a low sustainability rating, below investment grade (usually in the BB range or lower). This could mean increased interest rates or denial of credit by the, even if the company is otherwise credit worthy. Conversely, companies with high sustainability ratings could get preferred treatment, either in terms of costs or access to capital.

The Brazilian banking industry uses the same criteria as in most countries, based on Basel standards. In the present

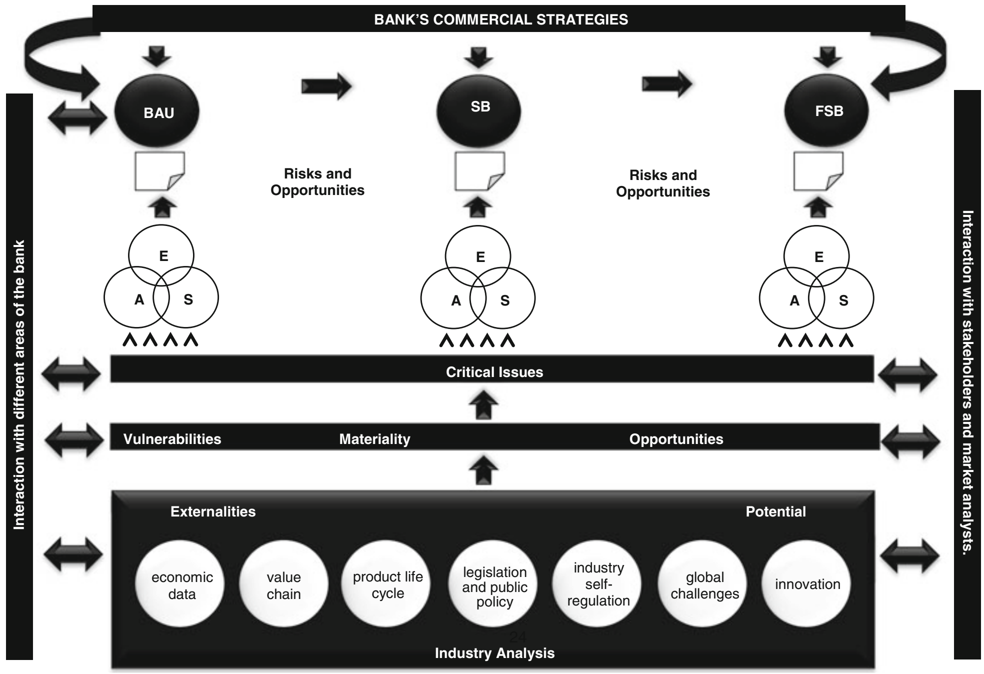

Fig. 1 Analytical methodology for the Sustainability Credit Score System

case, the Brazilian branch of the bank is chosen, because it has the most advanced sustainability department among the subsidiaries of the bank. The idea is that the SCSS is tested in Brazil and, if it improves the lending ability of the bank, is going to be introduced to the other branches of the bank around the world.

The SCSS is different than EPs which establish that projects over US$10 million should be analyzed through short-term sustainability impacts. Here the SCSS measures most companies in the industry, even small companies, and it focuses on both risks and opportunities for future sustainability. The goal of the SCSS is to measure each firm's potential contribution to sustainable economic production, given the industry's sustainability factors. Because sustainability is multidimensional and dynamic, there is no unique way to measure the impact of a single firm. For the present work, Fig. 1 below summarizes the whole analytical process that generates questions for the score system.

The methodology is based on a bottom-up approach. First is the industry analysis, followed by the definition of critical issues regarding the industry and its long-term sustainable path. We then distil these issues into their environmental, economic, and social aspects and relate them to the three main paths for sustainable development: BAU, SB, and FSB. Due to the inherent uncertainty of dealing with forecasting, we adopt a generic conception of these development stages.

- BAU refers to the present stage in which the industry practices are directly related to past practices, which may or may not be sustainable.
- SB is a future stage (mid-term, around 2020), resulting from the adoption of new sustainable practices by firms. These are mainly derived from emerging technologies, new commercial practices, and evolving legislation.
- FSB is a future stage (long-term, around 2050) marked by the foreseen role of the industry in a sustainable path that would allow continuing economic, social, and environmental development (WBCSD 2010).

From this relationship, we deduce risks and opportunities, which are the source of the credit score system.

The main contribution of this methodology is that the resulting credit score system can help to develop proactive short- and long-term commercial practices. We turn to this later, but a simple example of long-term commercial practices follows. By conducting a long-term analysis, we try to establish the possible future sustainability of the industry itself. For instance, let us assume that our analysis of the sugar industry shows that its long-term yield productivity is going to be low and that the only way for the industry to survive is to expand geographically into protected environments and/or displace other cultures, generating negative benefits for society. In this case, the FSB analysis would show that firms would only be able to achieve FSB practices if they change their core business by focusing on more sustainability-promising products. This could result in the development of credit strategies in which loans are given to companies investing in changing their business model toward a more sustainable one. On the other hand, it may be that the FSB is one in which firms are technological leaders and would be able to obtain much

Table 1 Industry data on the Brazilian Sugar Industry—2005 and 2012. US$ billion

	2005	2012
Industry value-added (sugar cane, refined sugar, ethanol and bioelectricity)	U$20 billion	U$42 billion
Value-added as a % of GDP	2.35 % of GDP	2 % of GDP
Employees (direct and indirect jobs)	3.6 million	4.5 million
Number of independent sugar cane producers	72,000 farmers	70,000 farmers
Sugar cane output (in millions of tons)	430	700
Refined sugar output (in millions of tons)	27	38
Ethanol output (in billions of liters)	17	27
Refined sugar exports (millions of tons/US$)	14/US$4 billion	20/US$14 billion
Ethanol exports (in billions of liters/US$)	2.5/US$1 billion	2/US$1 billion
Tax revenue (US$ billions)	6	7
Current investments (US$ billions)	U$2 billion/year	U$4 billion/year
Number of sugar mills and distilleries	300	430
Projects in progress	34	30

Sources IBGE (2012) and Jornal da Cana (2012)

better yields by focusing on new crops and new techniques. In this case, directing loans to firms searching for those opportunities could be part of a proactive long-term credit policy.

The Industry in 2012

The SCSS is tested through an application to the Brazilian sugar and ethanol industry (referred to as the sugar industry from now on), which combines two main characteristics that make it suitable as a first adopter: it presents environmental, social, and economic pressing issues (ethanol is considered a relatively clean source of energy) and is large enough to warrant a sustainability analysis by a commercial bank.

The sugar industry output in Brazil totaled U$32 billion in the 2011/2012 crop season, approximately 2 % of the Brazilian GDP, representing 50 % growth compared with 2005. The industry employs about 4.5 million people and processes around 700 million tons of sugar cane to produce 38 million tons of sugar and 27 billion liters of ethanol annually. Table 1 below reveals some data on the industry for the Brazilian economy. Relevant to the present work is the fact that the industry is composed of dozens of thousands of small producers and hundreds of industrial mills, which makes it costly to collect information to develop rating systems.

Brazil is the world's largest sugar cane producer. In the 2011/2012 crop season, sugar cane crops occupy an area of 8.1 million hectares: 0.95 % of Brazil's territory and 2.5 % of the country's cultivable land. Recently, it has added the generation of bioelectricity from sugar cane bagasse. Of the total 2011 industry output, 45 % was used to produce sugar and 55 % to produce ethanol. Roughly two-thirds of the refined sugar output is exported. Sugar cane-related activities employ 3.85 million people, and formal labor relations reach 79.6 % of the workforce.

Industry Analysis

The industry analysis methodology combines an in-depth examination of the industry practices with an analysis of the global challenges (WBCSD 2010). It forms the basis for all the subsequent analyses. Relating it to the global challenge allows us to decide on the major issues that firms—and consequently the sugar industry—have to address in the coming decades.

The variables that determine environmental, social, and economic changes are many, and the relationships among them are dynamic and complex. From the countless challenges and issues regarding sustainability (e.g., KPMG 2012; OECD 2012; United Nations 2012; United Nations Environment Programme 2011; WBCSD 2010), among many others, thirteen are selected, either because of their global comprehensiveness (such as water and climate change issues) or because of their relevance to the industry (such as transportation and mobility). For each one, we identify possible sources of sustainability risks, but also opportunities for the dynamic development of the industry. Table 2 shows the selected global challenges for the sugar industry in Brazil.

The next step is to relate these challenges to the sugar industry. We achieve this by dividing the analysis into six topics: economic outlook, value chain, life cycle, public policies and legislation, industry self-regulation and programs, and innovation.

Critical Issues

The industry has, in the last 5 years, established some important self-regulatory measures. These measures can be subdivided into programs, initiatives, and formal commitments. They attempt to mitigate some of the negative externalities generated by the industry.

Some of the initiatives are related to labor issues, such as labor productivity and minimum prices paid to producers. There is also an initiative for an international

Table 2 Global challenges and the Brazilian Sugar Industry

	Selected challenges	Impacts on the sugar industry
1	Climate change	This global challenge may have negative impacts, for instance on the biodiversity of agricultural land to produce sugar cane and on the amount (reduction) of water available to irrigate crops in the *Cerrado* region, but, on the other hand, it may allow for new frontiers for production. Also, changes in the energy matrix may create a demand for ethanol and energy from biomass as cleaner alternatives to oil and gas
2	Wealth, economy and consumption	This challenge may represent an increase in the labor cost, as well as migration from this to other industries
3	Biodiversity	The decline in biodiversity and in ecosystems may compromise sugar cane productivity and lead to the reduction of agricultural land, in order to preserve threatened biomes
4	Energy	For the sugar and ethanol industry, which generates its own energy, regulatory measures issued by the Government may be a concern, but the possibility of an increase in demand may point in the direction of increased business and new consumer markets. The industry shows high potential to contribute to changes in the energy matrix, not only supplying ethanol for transportation, but also producing electricity from sugar cane bagasse. One promising new product, for instance, is aviation kerosene produced from ethanol
5	Cities	This global challenge may represent, on the one side, opportunities to increase the demand for urban mobility products and, on the other side, disputes over scarce resources such as water
6	Water	This global challenge may represent an increase in the demand for food products but, on the other hand, it may provoke heated disputes over the raw materials necessary for industrial output
7	Food	The demarcation and the allocation of land for agricultural production intended to limit deforestation demand major productivity improvements in the areas destined for sugar cane cultivation. This requires investment in research on new varieties, with higher sucrose content
8	Forests and deforestation	Mechanization of the sugar cane harvest is a consequence of the need to avoid burning its residues but also to improve labor productivity. However, one of its consequences is the elimination of low-skilled workers. Also, increases in ethanol production under new processing conditions may add green jobs to the economy, not only in Brazil but also in other countries
9	Jobs and green jobs	The impact of this challenge on the sugar and ethanol industry may affect the ethanol production costs and create pressure on the ecosystem used to produce biomass
10	Shortage of inputs	The impact of this challenge on the sugar and ethanol industry may affect ethanol production costs and create pressure on the ecosystem used to produce biomass
11	Transportation and mobility	The use of machines and equipment and the transportation of sugar cane to the mills and from there to the market require fossil fuels, which in turn increase CO_2 emissions. At the same time, ethanol represents an important source of clean energy and contributes to reducing the utilization of fossil fuels
12	Population Growth	Population growth may affect the industry as the increase in the consumption of renewable forms of energy results in higher demand for ethanol, and hence greater demand for land. However, new technologies may counterbalance this effect
13	Organizational governance	Corporate governance issues may result in more professional companies, especially as family-owned companies evolve. Better governance should bring transparency and ethical and better self-regulation. The commoditization of ethanol may require compliance with global regulations related to sustainability matters

environmental standard, called Bonsucro Certification. This attempt to gain acceptance among international market players is especially important for ethanol, because commoditization breeds market penetration.

Innovation is a key to the development of the sugar industry, whichever development path it should take. There are many R&D initiatives regarding the development of new sugar cane varieties, but also relevant is innovation in terms of industrial flexibility in ethanol and sugar production.

The results from the previous analyses indicate 70 issues relevant to the sustainability of the Brazilian Sugar Industry. On this set of issues, further analysis is carried out, and we select 34 critical issues. Those issues are organized in eight categories.

The next step is to give materiality to the groups of selected critical issues. First, we divide the issues and relate them to the dimensions of sustainability. The purpose is to provide guidelines for the intra-industry relationship between firms and relation to their stakeholders.

Business as Usual (BAU), Sustainable Business (SB) and Future Sustainable Business (FSB)

We then proceed to separate the group of critical issues into a development path represented by three categories: BAU, SB, and FSB. Each one is defined as follows: BAU—the average firm in the industry; SB—the top tier of firms regarding sustainable practices; FSB—the average sustainable future firm, in which innovations shape the industry according to sustainability requirements. There are two main paths for development: the dissemination of sustainable practices, in which the average firm turns to sustainable practices (from BAU to SB); and the innovation path, which leads firms from their present sustainable practices to future sustainable practices (from SB to FSB). We establish SB practices for the sugar industry, which form the basis of the credit score in the next section.

The last informational step is to determine which of the many potential risks and opportunities would be relevant to the strategies of a commercial bank. We filter the information through two development paths—from BAU to SB and from SB to FSB. The risks and opportunities are divided into credit and reputational categories and can be found in "Appendix 2."

Weights, Iteration, and Measurements

For the final measurements, we need to assign weights to the different development paths and the different sustainability dimensions. We use subjective criteria. The subjective criteria are going to be validated through the testing of the questionnaire in the field through successive iterations of the process. After testing it with a few companies, the final measurements should be evaluated and then the criteria can be refined. There is no inherent problem with qualitative and subjective criteria in credit risk modeling in general, which has a long tradition. Agencies today are calling for more subjectivity in their credit risk models, a point that is contentious in the financial literature—Griffin and Tang (2012) are skeptical of allowing subjectivity in such models. Model validation is paramount to risk modeling using subjective criteria (Jones and Mingo 1999), and in the present case, the absence of extensive quantitative data makes the validation process even more important. The central idea behind the validation process is that it is conducted by the research department of the bank. The SCSS is an evolving tool, with changes being incorporated to reflect the feedback from the application of the questionnaires.

Sustainability Credit Score System

The analytical methodology has one main goal: to support the development of a questionnaire that, when applied to the firms in the sugar industry, reveal their credit-worthiness based on sustainability issues.

The SCSS is based on an AHP method and is divided into two parts: structuring and evaluation. In the first part, we decompose the critical issues and risks into a hierarchical structure. In the second, we define the relationship between the hierarchies. The AHP demands comparisons, in pairs, among criteria/alternatives that belong to the same hierarchical level. The next steps are:

(1) We compare the relative importance of eco-efficiency (EE), socio-environmental (SE), socio-economics (SD), environmental protection (EP), economic growth (EG), and social progress (SP). At the end of this phase, we obtain a 6 × 6 comparison matrix.

(2) Next, for each of the six previous dimensions, we compare the respective critical issues. For instance, for social progress, three questions are compared—which, in turn, result in a 3 × 3 comparison matrix.

(3) Finally, for each question, the level of development of the firm, relative to the sustainability criteria relevant to the sugar industry, is established. In this case, for each question, the possible answers are classified as "below business as usual (nBAU)," "business as usual (BAU)," "sustainable business (SB)," and "potential future sustainable business (FSB)."

We present the AHP methodology in "Appendix 3." The main result is that the credit score, which ranges from 0 to 1, ranks firms in terms of their sustainability and creates information to allow a bank to develop commercial strategies such as: lending practices; short-term strategies based on local branches—for instance, the funding of new projects related to R&D or the transportation of vinasse; long-term policies such as the funding of research centers and lending to companies in frontier regions; and reputational exposure to the industry and specific firms. Most of these results can be achieved by a detailed analysis of the industry, but the advantage of the SCSS is that by distilling all the information into a questionnaire that results in a comparable number for each firm, financial institutions are free to incorporate it into their more established credit models.

Using the SCSS

Using the SCSS means developing a questionnaire to be completed by branch and account managers with private information regarding firms in the sugar industry. There are two necessary conditions for the SCSS to be effective: information gathering and incorporation into the decision-making process. There is no hard evidence that the SCSS is actually efficient in classifying firms based on sustainability issues, and it can easily be discarded if an organization feels that it is not accomplishing its main goal. Unless it has internal ramifications, the commercial bank will be stuck in its BAU mode, even though the main objective is to move toward a future SB.

However, if used well, it can change the criteria used to make loans and to establish portfolio allocation. It fits well into the framework of Weber (2005) and can bring forth concrete information on how banks value the CSR practices of borrowers [as in Ghoul et al. (2011) and Dhaliwal et al. (2011)]. There is precious little information on banks' management practices regarding CSR, but if firms in the industry start adopting mechanisms similar to the SCSS, sustainability may be driven voluntarily instead of being forced by regulation; this scenario would generate positive externalities for society. The present case shows an example of a bank that is trying to act in a more socially responsible way to enhance its competitive advantage, which corroborates the result of Chih et al. (2010).

Conclusion

As late as 2008, less than one-third of banks around the world published sustainability reports. Five years later almost all of them do. However, sustainability is still not a deciding factor in risk models by commercial banks. We argue that developing a SCSS can provide value creation for a bank and positive externalities to society. We show the development of such a system for a multinational bank, which is using the system for rating companies in the sugar industry in Brazil. The development of the SCSS consists of the following stages:

- Selecting the industry, with corresponding analysis of its economic outlook, product life cycle, value chain, legislation and public policy, industry self-regulation, and innovation.
- Measuring paths for the average firm: BAU, SB, and FSB.
- Defining variables related to individual firms, in each of six sustainability dimensions: economic growth (EG), environmental protection (EP), social progress (SP), socio-economic development (SD), eco-efficiency (EE), and socio-environmental development (SE).
- Unveiling of the materiality issues pertaining to the average firm, plus vulnerabilities and opportunities regarding the sustainability of the industry.
- Combining the information to obtain questions for the composition of the score system.
- Defining the weights for the analytical hierarchy process.

Firms that rank low on the SCSS would be denied credit, even if they are financially sound. The SCSS is a CSR policy but also tries to build a competitive advantage for a financial institution by reducing the bank's long-term exposure to reputational risk. There is precious little evidence of internal management practices regarding sustainability. Financial products that are based on sustainability issues, like sustainable funds, abound, but the criteria for selecting companies are usually based on sustainability reports. Internalizing sustainability into everyday banking operations is a major challenge. Commercial bank has the ability to become proponents of societal changes. The implication for managers is clear: banks that take into account sustainability into their lending decisions would have less reputational risks and could build competitive advantage by having less default in the long run than the average bank. The SCSS is related to the EPs, but it focuses on companies instead of large-scale projects—it also tries to gather information on risks and opportunities for future sustainability, instead of short-term impacts.

There is still no hard evidence that incorporating sustainability into credit score systems leads to less defaults. Future research could show if that is the case.

There are plenty of other avenues for further research. The first is to try to gain a better understanding of how new management practices that rely on CSR relate to building competitive advantage. Are market mechanisms relevant to the financial industry or should more regulation promote lending policies that are based on sustainability? Also, more direct evidence of new practices, such as the SCSS, may help us to understand how the financial industry is evolving regarding internal management practices based on sustainability.

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Appendix 1: Examples of Firms' Practices in the Brazilian Sugar Industry

BAU	SB	FSB
Geographical occupation		
The industry currently carries out geographical occupation according to the Sugarcane Agroecological Zoning and to licenses granted to single firms	The industry complies with the Forest Code and creates its own legal reserves or in association with others	There is a balance between planted and preserved areas, owned by either enterprises or by suppliers, regardless of the biome where they are, ensuring local biodiversity and protecting water springs and hydrographic basins

BAU	SB	FSB
The industry has not yet expanded as necessary to respond to the current demand for sugar and ethanol	Adequate expansion, in areas large enough to respond to the demand for ethanol and sugar, preserving biomes, water springs, hydraulic basins and biodiversity	The industry does not need to expand anymore, since its productivity is sufficient for responding to the market demand for products
Although new fully mechanized plantations are being developed, the industry still occupies a large area (mainly in the Northeast) where declivity is higher than 12 %, rendering the burning of leaves necessary	All plantations are in areas with declivity below 12 %, fully mechanizable and free from the burning of leaves	The soil of occupied areas is thoroughly researched, as well as water availability, biodiversity and adequate sugar cane varieties, enabling the development of an agriculture of precision
The industry competes with food production in areas where farmers may alternate between sugar cane and other crops, such as leguminous crops, depending on the market value of each crop	The industry occupies areas where it does not compete with food production or, whenever there is competition, crops are alternated in an efficient way	Short cycles of different crops in the same area enable three to four complementary and different crops a year and help improve soil productivity (for instance sugar cane, beans, peanuts and forage)
Climatic changes still do not impact on current plantations and most of the industry seems not to be concerned with anticipating what may happen to its enterprises	The industry invests in research on climatic changes, identifying new and adequate areas for sugar cane cultivation	Occupation of new areas, selected according to climatic changes, without impacting on biomes and biodiversity
Clean energy/new products from ethanol		
The sugar and ethanol industry's carbon footprint increases due to the use of fossil fuel to power sowing and harvesting machines and vehicles that transport goods between farms, mills and points of internal commercialization and exportation	Gradual replacement of vehicles and equipment powered by fossil fuels in favor of biofuels and machines equipped with more efficient engines	Transportation during planting, harvesting and commercialization is carried out with minimal carbon emission (vehicles and machines are powered by biofuels and technologies such as alcohol ducts)
The industry is under the influence of an erratic policy dictated by the Brazilian Government in regard to both taxes and stimulation of the production of ethanol (control over gasoline prices) and bioelectricity (the price of biomass energy does not reach attractive numbers in auctions)	Influence on public policies to stimulate production and commercialization of ethanol and bioelectricity, aiming at the reduction of CO_2 emissions	Ethanol and bioelectricity are important components of both Brazilian and global energy matrices, together with public policies and incentives adequate for the society's high demand for clean and renewable forms of energy
Ethanol from sugar cane is still not competitive with ethanol from corn	Research on second- and third-generation ethanol and on engines powered by biofuels is at an advanced stage, making sugar cane ethanol more competitive and accepted, especially in relation to fossil fuels, which incorporate the mitigation costs of social and environmental damage	Ethanol's traceability increases its value in the international market
Bioelectricity from sugar cane bagasse makes mills self-sufficient, but only 25 % of the mills sell energy to public utility companies due to the high cost of infrastructure	Incentives for the production and commercialization of bioelectricity by construction of adequate distribution infrastructure	Bioelectricity from sugarcane bagasse has lower production costs and higher market value
Incipient research on alcohol chemistry and bioplastics, as well as on sugar cane fuel for aviation	Alcohol chemistry products, ethanol aviation fuel and bioplastics are commercially available, but still on their way to becoming sustainable products	Expanded portfolio of alcohol-chemical products, bioplastics and fuel for aviation widens the market for the sugar and ethanol industry

Appendix 2: Risks and Opportunities for a Commercial Bank in Relation to the Brazilian Sugar Industry

Credit Risks

(1) Companies displaying the characteristics, or risk factors, listed below may present credit risks to banking operations:

- "Non-compliance" with legislation.
- Use of sugar cane varieties inappropriate for the region.
- Operation in an area where the water supply is compromised.
- Low productivity.
- Limited capability to manage the product mix.

- Sugar cane planted in areas of declivity higher than 12 %.
- Manual harvesting is not replaced by mechanized harvesting, and burning of leaves is not abandoned.
- Labor practices inadequate for retaining the agricultural labor force.
- Inadequate use of water.
- Contamination of soil and groundwater by fertilizers and agrochemicals.
- Inadequate fertilization of plantations.
- Inadequate managerial and governance practices.
- Use of obsolete equipment throughout the production process.
- Non-use of technological improvements such as new sugar cane varieties, sorghum, direct planting, precision agriculture, generation of electrical power, etc.
- Failure to obtain environmental licenses.
- Inappropriate contracts with sugar cane suppliers.
- Negligence in tracking the impacts of climatic changes.
- Co-responsibility in lawsuits filed against companies of the industry with regard to socio-environmental issues.

Reputational Risks

(1) Pressure (from media, society, non-governmental organizations, etc.) on clients due to incorrect socio-environmental postures, such as

- Illegal use of transgenic varieties;
- Contamination of soil and groundwater and failure to preserve water;
- Uncontrolled product quality and safety during distribution;
- Dismissal of large numbers of employees without adequate requalification and attempt to reinsert into the labor market;
- Burning of sugar cane leaves prior to harvest;
- Use of machines that damage the soil;
- Production of sugar using toxic elements or contaminants.

(2) Financing of companies that are

- Operating illegally;
- Adopting illegal labor practices and/or committing human-rights abuses;
- Using new technologies that are illegal according to the current legislation;
- Distributing adulterated ethanol or evading sales taxes.

(3) Inappropriate behavior of clients relative to their managerial practices and information transparency.

Opportunities

(1) Provision of consulting advice to clients (in seminars, workshops, and published papers) on

- Areas more appropriate for sugar cane cultivation as a consequence of climatic changes;
- Varieties appropriate for given regions and biomes and new cultivation techniques.

(2) Financing and investments to help the industry

- Face productivity challenges related to the use of adequate sugar cane varieties;
- Expand industrial facilities (construction of new mills, renovation of existing facilities, and introduction of equipment embedding more advanced technologies);
- Produce second- and third-generation ethanol;
- Replace the existing fleet by vehicles powered by renewable energy;
- Mechanize production (purchase of equipment, employees' qualification program, etc.);
- Develop more sustainable equipment to manage sugar cane plantations;
- Tackle the high costs related to compliance with some legal requirements, such as the use and disposal of water;
- Change the fertilization processes (construction of vinasse ducts, research on soil type, and adequate amounts of fertilizer, etc.);
- Introduce international governance standards and data transparency;
- Close the water and natural resources cycles in industrial processes.

(3) Tracking information on

- Technologies suitable for trucks, machines, and equipment powered by ethanol;
- The development of new markets and products from sugar cane;
- Initiatives to qualify workers, supporting intra-industry programs, institutions, and NGOs;
- Research on new sugar cane varieties and new cultivation techniques;
- Climatic changes.

Appendix 3: The Methodology of the Sustainability Credit Score System

The comparison matrix has the following generic format: $A = (a_{ij})_{1 \le i,j \le n}$

where

$$a_{ij} = \begin{cases} 1 & \text{if } i = j \\ 1/a_{ji} & \text{if } i \neq j \end{cases}$$

The numerical values in the comparison matrix can be obtained in Saaty's Relative Importance Table, which follows:

Intensity	Relative importance
1	Equal relative importance
3	Slightly superior relative importance
5	Strong relative importance
7	Very strong relative importance
9	Absolute relative importance

We build a six-dimension comparison matrix. Two premises are assumed before the comparisons are carried out: the first defines that the intersections between two dimensions of sustainability are preferable to singular dimensions, because practices in the first fields tend to balance distinct objectives better. The second premise prescribes that, when compared with each other, the areas of intersection of dimensions and singular dimensions have similar relative importance. This is to avoid focusing on a specific aspect (for instance, prioritization of economic growth).

We obtain the following six-dimension comparison matrix:

	EE	SA	SE	EP	EG	SP
EE	1	1	1	3	3	3
SA	1	1	1	3	3	3
SE	1	1	1	3	3	3
EP	1/3	1/3	1/3	1	1	1
EG	1/3	1/3	1/3	1	1	1
SP	1/3	1/3	1/3	1	1	1

For the comparison matrix above, in line with the AHP, the normalized relative-weight vector may be obtained as follows:

SP	0.25
SE	0.25
EG	0.25
EE	0.08
OS	0.08
AS	0.08

The inconsistency level is 0 % (below the usual 10 % level, which is the maximum accepted level in the AHP methodology).

The next phase requires the preparation of comparison matrices for the indicators associated with each dimension considered. For each indicator, four relative degrees—relative to nBAU, BAU, SB, and FSB—are assigned, as well as the relationship to GRI. The last step, not presented here, is the development of the questionnaire based on each issue and that is used to determine each firm's sustainability credit score.

The comparison matrices and their weights for the sugar industry are

(1) Eco-efficiency

(a) Use of water (EN9)
(b) Improvements to cultivation and production equipment (EN18)
(c) Productivity and sugar cane variety (EN14)

The comparison matrix is

	a	*b*	*c*
a	1	3	1
b	1/3	1	1/3
c	1	3	1

The normalized relative-weight vector is

a	42.86 %
b	14.29 %
c	42.86 %

The level of inconsistency for this last comparison matrix is 0.00 %.

(2) Socio-environmental

(a) Environmental impacts on the community (SO1)
(b) Reduction in fossil fuel use (EN17 and EN29)
(c) Elimination of burning practices (EN16)

The comparison matrix is

	a	*b*	*c*
a	1	3	1
b	1/3	1	1/3
c	1	3	1

The normalized relative-weight vector is

a	42.86 %
b	14.29 %
c	42.86 %

The level of inconsistency for this last comparison matrix is 0.00 %.

(3) Socio-economics

(a) Compliance (PR9)
(b) Requalification of workers (LA11)
(c) Influence over public policies (SO5)

The comparison matrix is

	a	*b*	*c*
a	1	1	3
b	1	1	3
c	1/3	1/3	1

The normalized relative-weight vector is

a	42.86 %
b	42.86 %
c	14.29 %

The level of inconsistency for this last comparison matrix is 0.00 %.

(4) Environmental Protection

(a) Reduction in the use of chemical inputs such as fertilizer and agrochemicals (EN22)
(b) Compliance with natural resources and biodiversity protection legislation (EN28)
(c) Production expansion without an increase in environmental impacts (EN11 to EN13)

The comparison matrix is

	a	*b*	*c*
a	1	1	3
b	1	1	3
c	1/3	1/3	1

The normalized relative-weight vector is

a	42.86 %
b	42.86 %
c	14.29 %

The level of inconsistency for this last comparison matrix is 0.00 %.

(5) Economic growth

(a) Company governance/information transparency (LA13)
(b) Product development and evolution (EC1)
(c) Economic development of the community (EC7)

The comparison matrix is

	a	*b*	*c*
a	1	1	3
b	1	1	3
c	1/3	1/3	1

The normalized relative-weight vector is

a	42.86 %
b	42.86 %
c	14.29 %

The level of inconsistency for this last comparison matrix is 12.32 %.

(6) Social progress

(a) Adherence to the National Good Labor Practices Commitment (HR7)
(b) Human-rights-related policies and procedures (HR8)
(c) Investments in the development of communities (EC8 and EC9)

The comparison matrix is

	a	*b*	*c*
a	1	1	3
b	1	1	3
c	1/3	1/3	1

The normalized relative-weight vector is

a	42.86 %
b	42.86 %
c	14.29 %

The level of inconsistency for this last comparison matrix is 0.00 %.

Finally, the comparison matrix for the four possible answers considered—"FSB," "SB," "BAU," and "nBAU"—is

	FSB	SB	BAU	nBAU
FSB	1	1/3	1/5	1/9
SB	3	1	1/3	1/5
BAU	5	3	1	1/3
nBAU	9	5	3	1

The normalized relative-weight vector is

a	53.71 %
b	27.85 %
c	13.53 %
d	4.91 %

The level of inconsistency for this last comparison matrix is 3.81 %.

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