Evaluation of the Bonsucro calculator as a sustainability performance benchmarking tool in the sugarcane sector

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Abstract  Bonsucro was set up in 2008 by a group of stakeholders to support the sugarcane sector in improving its sustainability performance. The organisation designed a metric-based performance standard that provides operators with a set of measurable sustainability objectives. To allow a consistent measurement of performance, Bonsucro has developed the Bonsucro Calculator. It relies on the collection of a set of real production data to measure the performance of social, environmental and technical practices ranging from agriculture activities (e.g. yields), to milling activities (e.g. recovery of sugar), as well as social impact (e.g. accident rate), through to environmental impact (e.g. GHG emissions). The Bonsucro Calculator uses the data to demonstrate sustainability performance against metric thresholds and to grant operators (mill and farms) with a Bonsucro Certificate. Since its launch in June 2011, 59 mills and cane supplying areas have used the calculator on a yearly basis. That has provided the organisation with over 50,000 verified individual production data points captured on Excel spreadsheets. Using visualisation software, it has been possible to represent aggregated data to identify individual producer performance in relation to the performance of all Bonsucro certified mills and farms. This paper evaluates three examples of benchmarking performance and the opportunity of learning from best performers created by the visualisation of data. Taking into account the results and the identified challenge of transferring knowledge, the conclusion evaluates the potential application of the Bonsucro Calculator as a tool for global sustainability performance management and improvement in the sugarcane sector.

Key words  Benchmarking, sustainability performance, Bonsucro, metrics, sugarcane

INTRODUCTION

Sustainability has become a key element of everyday business management. It is less and less common to find companies that do not claim that they perform activities that are linked directly or indirectly to sustainability.

Bonsucro was set up by the sugarcane sector to provide farm and mill operators with a reference tool that defines the sustainable conditions for the production of sugarcane and sugarcane-derived products. To do so, it has developed and implemented standards that define the performance level that operators should attain to be recognised as sustainable. The performance-based approach developed in the Bonsucro Production Standard is a novel approach in the field of sustainable agriculture standards that has been dominated by management-based standards. To evaluate the performance of operations, the Bonsucro Production Standard (here on referred to as Standard) relies on a number of metric indicators and thresholds that must be met by operators. The Standard is comprised of principles, criteria and indicators, split across the three pillars of sustainability: environmental responsibility, economic return (efficiency), and social wellbeing. The Standard was developed based on stakeholder and expert engagement to increase its acceptance by the sugarcane sector.

This paper presents the results of evaluating the use of the Bonsucro Calculator as a tool for benchmarking sustainability performance by leveraging data collected for the purpose of certification to provide valuable information back to the producers that demonstrate sustainability. The methodology of data collection and analysis for this paper is firstly described. Then three visualisations are presented, one in each pillar of sustainability, and analysed for their use in sustainability performance benchmarking and potential value to the producer. The first one is an example from the economic dimension of sustainability where data from mill efficiency is visualized to determine the best performer. The second example illustrates the impact of land-use change on greenhouse-gas emissions, an important aspect of environmental sustainability. The third analysis compares data from accident frequency to the length of the crushing season to identify best performers within peer groups of similar situation. The paper concludes with an evaluation of how the Bonsucro Calculator can be a valuable tool for the sugarcane sector in improving its sustainability performance.
METHODOLOGY AND RESULTS

A sustainability performance measurement system can be defined as “a system of indicators that provides a corporation with information needed to help in the short and long-term management, controlling, planning, and performance of the economic, environmental, and social activities undertaken by the corporation” (Searcy 2012). However, some of the systems for measuring sustainability performance may not be adequate. Boiral and Henri (2015) reflect on the need for operators from the same sector to follow the same reporting guidelines. Harmonising the methodologies of the underlying measurements in a comparable way is also important to allow for less subjective comparison among performances (Veale and Seixas 2016).

Evidence from psychology and management studies shows that benchmarking against similar peers can be a powerful tool for driving performance improvement (Veale and Seixas 2016). This is demonstrated by the examples in smart metering and household energy consumption improvement (Darby 2006). The process of benchmarking varies according to the industry or the type of company carrying the benchmark and its objectives in terms of learning and improvement (Pryor 1989).

Following the literature (see Moriarty 2011), for any type of benchmark the key steps are:

1. Collection of context/category data (such as size and location in the case of companies, or age and education in the case of individuals) and performance data;
2. Identification of typical performance and of best-in-class companies for a given function or performance area;
3. Comparison of companies with divergent performance but similar context/category and assessment of causes for diverging performance;
4. Recommendations for improvement.

What separates benchmarking processes from straight-forward comparisons is the transfer of knowledge, experience, technology, processes, or resources from a best-in-class company to achieve improvement (point 4 above). It is important to mention though that learning happens even if these transfers do not happen, since the work carried out internally for a benchmark may increase self-knowledge and better understanding of the causes of lower performance, the inferences on causations mentioned before can themselves lead to improvement (Pryor 1989).

This paper argues that the Bonsucro Calculator has the potential to become a powerful sustainability benchmarking tool for sugarcane mills and farmers. As we will demonstrate, the calculator directly addresses key steps 1 to 3 above, and it may support the identification of causes for diverging sustainability performance.

Bonsucro has developed a calculator to consistently report and measure performance of operators against the series of sustainability indicators defined in the Bonsucro Production Standard (2014). The indicators are metric (73%) and qualitative (27%). The Bonsucro Calculator is an Excel based document which provides operators with a list of data they are required to collect from their production activities (referred to as Input data (Bonsucro Calculator 2016)). The data are computed and evaluated by a series of calculation operations, and a performance score is generated against each indicator (output data). The performance score is calculated using consistent methodology developed by technicians in the sugarcane sector and brought to wider consultation (Viart and Rein 2013). For example, a mill reports the performance data of water use, and the Bonsucro Calculator will then calculate the water use per tonne of sugar produced, which is the output data. This is then compared to a metric threshold defined in the Standard to determine if the operator is compliant or not with the requirement (in this case less than 20 kg of water per kg of sugar produced). For a given operator, the combination of its input data and output data is referred to as the dataset. In the process of certification, which is the current main use of the Bonsucro Calculator, datasets are updated annually to verify continuous compliance of operators with the Bonsucro Standard. Data verification is put under the responsibility of the licensed certification bodies (Bonsucro Certification Protocol 2015).

Since the first certification in June 2011, Bonsucro has collected 173 verified datasets from sugarcane operators in seven countries as well as five non-verified dataset from five countries. The database used for this study comprises over 50,000 data entries covering a period between July 2011 and December 2014. The data collected includes performance and contextual data (for example total volume of sugarcane crushed, total volumes of sugar produced, number of employees) that are the key first step for effective benchmarking processes.

The following analyses take a mixed-method research approach, including visualisation to observe best performers and impacts, and analysis draws from literature and the authors’ experience in the sugarcane sector. The production data of both milling and agriculture activities of 61 mills, certified between January 2011 and December 2014, have been analysed.
in this study. For each indicator studied, the data are made of the arithmetic means the recorded result across the dimension studied.

RESULTS

Benchmarking mill efficiency for economic sustainability

We selected two key indicators related to economic sustainability: percentage of field burnt and raw juice purity to compare production-related indicators across the data set.

Figure 1 represents the observed data comparing percentage of land burnt before harvest and the purity of the raw juice. Burning cane before harvest directly impacts the raw juice purity (Meyer and Eggleston as cited by Mahadevaiah et al. 2013). By mapping the two data sets below, it is possible to mills to benchmark their respective point of performance among their peers and to evaluate the potential impacts of changes in percentage of field burnt on raw juice purity. For example, mill M44 could estimate what would be the possible impact on the raw juice purity of reducing its burning rate from 90% to 50% or beyond. This way, it could forecast the consequences in terms of operation efficiencies at mills and adapt accordingly to limit the expected reduction of juice purity and sugar recovery by benchmarking with another mill or best performers from which they can evaluate the divergences in their practices. Using the available data in Figure 1, the mill can consider the performance of M47 (similar percentage of burnt field, but higher raw juice purity) and M25 (best performer in both measurements).
Benchmarking greenhouse gas emissions and land-use change for environmental sustainability

The second case in the study evaluated the potential for benchmarking greenhouse gas (GHG) emissions. Typically unknown by the producer, the Bonsucro Calculator uses performance data collected by individual mills and applies a common sugarcane-specific Life Cycle Analysis methodology, adapted from the GREET model (Wang et al. 2008), to calculate GHG emissions per tonne of cane, sugar and ethanol. Our study focuses on GHG emissions from sugarcane production. The environmental sustainability dimension of our study further focuses on the impact of the exclusion or inclusion of land use change (LUC) on GHG emissions. Figure 2 shows the considerable influence LUC has on GHG emissions.

![Figure 2. Evolution of GHG emissions for cane production - Bonsucro certified mills: (left) GHG emissions excluding mills reporting land-use change; (right) GHG emissions including mills reporting land-use change.](image)

Land use change is defined as land that has been converted from one type of use into another, using definitions published by the Intergovernmental Panel on Climate Change, but excluding land converted prior to 2008. For example, whilst operators not using converted land have stabilised their GHG emissions to 30.2 kg CO₂eq./t cane (Fig. 2 left), operators relying on land converted after 1 January 2008 showed an increase in their emissions reaching 64.3 kg CO₂eq./t cane (Fig. 2 right).

The visualizations if used in benchmarking, shows the impact of land use change on GHG emissions and allows individual operators to react to the impact of land conversions as a means of reducing GHG emissions.

To support the findings of the benchmark in Figure 2, the number of mills including land use change in the reporting period has been taken into consideration. The analysis presented in Figure 3 indicates that there has been a diminution in the number of mills including newly converted land into their unit of assessment. Whilst it does not mean that such land is no longer used for the production of sugarcane, it shows that operators might wish not to negatively impact their overall GHG performance by including this land in reporting. As shown in figure 3, despite the decrease in the number of producers reporting land use change, the overall greenhouse gas emissions from producers including land use change has continued to increase. Should the supply-chain actors continuously increase their demand for certified material, operators would have to adapt their land management practices to deliver material which GHG emissions fall into the requirements set by Bonsucro.
Benchmarking number of accidents for social sustainability

We also determined how the length of the crushing season relates to the number of accidents expressed as accidents per million hours worked (Fig. 4). An accident is defined as an injury involving a worker which causes him/her to miss his/her next shift due to injury.

We saw a change in pattern when the crushing season is over 220 days. This information could inform individual operators of the impact of long crushing seasons on the risk of occurrence of accident (in regions where the season is over 220 days). The change in pattern in shorter season (<150 days) is not considered as representative due to the effect of one accident on the overall result. The study enables identification of the best performer (M13) which could be used as a
reference by peer operators and to which practices from other operators could be compared. From an operator point of view, it can help management to take additional preventive measures to mitigate the risk of occurrence of accidents when crushing seasons exceed 220 days.

DISCUSSION

As demonstrated by the examples above, the Bonsucro Calculator collects contextual and performance data in a standardised and reliable way (fulfilling the first step of effective benchmarking). It allows the identification of best-in-class performance, as well as the identification of typical performance for its metric indicators, both in an individual-producer basis (Figs 1 and 4) and in an aggregated or ‘filtered’ basis (Fig. 2), thus fulfilling the second condition for effective benchmarking. Our results show that the tool allows the evaluation of performance against indicators relating to social, environmental and economic criteria.

Evaluating performance through a data-focus tool allows the identification of performing practices and drives their spread and implementation. It operates a selection amongst a pool of unknown practices (as they are not captured in the tool) in a total agnostic and objective way and purely based on the performance attainment. The ability to compare best-in-class performance and understand the potential reasons for diverging performance within similar contexts is one of the key strengths of the Bonsucro Calculator and addresses the third step for effective benchmarking.

Mayer-Schönberger and Cukier (2013) identify how access to data can change how we predict what will happen. By discovering patterns and correlations in the data, it will become far more rapid to identify where to focus detailed causality analysis. As demonstrated in the GHG emissions’ analysis (Fig. 3), the Calculator was able to provide data that identified a cause (land conversions) for disparity of GHG emission results in similar contexts. The use of data analyses speeds up the understanding of observations. Nonetheless, its weakness is that some of the data for assessing possible causes for diverging performance may not be recorded in the calculator itself, therefore for specific issues other contextualisation datasets may need to be brought in or the range of data collected increased.

Another weakness of the Bonsucro Calculator is on the fourth condition of effective benchmarking: the recommendations for improvement. This is a relevant step in the process because operators need support in interpreting the result of benchmark and in deciding what courses of action to take (Darby 2006). The Bonsucro Standard was built on the premise of allowing producers to adopt the most locally-appropriate technology to achieve its targets, and for this reason the Bonsucro Calculator does not capture information on practices or technologies, thus not allowing provision of effective recommendations following the benchmarking processes (not from Bonsucro at least).

The benchmarking capacity will gain in scale and efficiency when knowledge related to practices carried out by best performers are captured and shared in a central repository. As seen above, if an operator wants to reduce the percentage of land burnt before harvest, it could estimate the possible consequences of such change on the raw cane purity (but also on any other indicators covered by the calculator such as GHG emissions, acidification of the atmosphere, or Factory Performance Index). If the operator wants to mitigate any negative impacts, they will need access to a bank of knowledge of successful change strategies. As such, the Bonsucro Calculator must be supported by a systematic identification of best performers and collection of case studies that would give operators access to a database of practices. In turn, this would provide the sugarcane sector with the effective benchmarking tool to support sugarcane operators but also a wide range of stakeholders including government bodies and civil society organisations in defining policies and implementable actions to increase the sector sustainability performance.

CONCLUSION

By adopting the visionary direction of setting a robust metric-based sustainability Standard, Bonsucro has developed a credible and adapted tool that enables objective and comparable evaluation of sustainability performance of and between sugarcane operators. It has the strength to offer operators an inward looking tool (allowing trends to be identified in individual results) and an outward looking tool (helping buyers and policy makers to identify measurable risks within their supply chains).

This paper attempted to demonstrate how the calculator effectively collects contextual and performance data in a reliable manner, how it allows for the identification of best-in-class and typical performances, and how it can compare diverging performance within similar context, thus fulfilling the three initial conditions for effective benchmarking. The paper also discussed some of the shortcomings of the Calculator, particularly related to the fourth condition (recommendations for improvement), and how it can be addressed.
The calculator is a tool and shall only be seen as a tool. Already quite comprehensive from the point of view of the amount of data collected and the opportunity to benchmark results, it also lays the foundation for the creation of a library of global performing practices, ranging from operational performance to social and environmental practices. Coupled with benchmarking opportunities, it could potentially offer operators and the wider sugarcane sector a strategic and management tool to drive medium and long term decision making and improvement.

REFERENCES


Evaluation du calculateur Bonsuco comme outil de comparaison des performances de durabilité dans le secteur de la canne à sucre

Résumé. En 2008, un groupe d’acteurs du secteur de la canne à sucre ont créé l’organisation Bonsuco dans le but de supporter le secteur à améliorer ses performances en termes de développement durable. L’organisation a développé une norme proposant aux opérateurs du secteur un ensemble d’indicateurs et d’objectifs métriques utilisés pour évaluer leur performance durable. Pour s’assurer de la consistance de ces évaluations, Bonsuco a développé le Calculateur Bonsuco. Son utilisation repose sur la collecte de données réelles de production qui permet le calcul de la performance sociale, environnementale et techniques des opérations agricoles (par ex. rendements, industrielles (par ex. taux de récupération du sucre) et de mesurer leur impact social (par ex. taux d’accidents) et environnemental (par ex. émissions GES). Se basant sur les données collectées, le Calculateur permet d’évaluer si les opérateurs (fermes et usines) atteignent les objectifs métriques définis dans la norme et de recevoir le certificat de conformité Bonsuco. Depuis son lancement en Juin 2011, 59 usines ont utilisé le calculateur et tous les ans ont mis à jour leurs données industrielles et agricoles. Bonsuco a pu ainsi collecter plus de 50,000 données uniques et validées. Utilisant un logiciel de visualisation, Bonsuco a pu produire des représentations graphiques des données agrégées et ainsi placer les performances individuelles dans le contexte de la performance de tous les opérateurs agricoles et industriels certifiés. A travers trois exemples, l’étude évalue comment de telles visualisations permettent de comparer les performances durable des opérateurs certifiés et ainsi d’identifier les plus performants d’entre eux pour potentiellement créer des opportunités de transmission de savoir. Prenant en compte les résultats de l’analyse et les problèmes identifiés dans la transmission du savoir, l’étude concourt sur la possibilité pour le calculateur Bonsuco de devenir un outil de gestion globale et d’amélioration de la performance durable dans le secteur de la canne à sucre.

Mots-clés: Comparaison, performance, durabilité, Bonsuco, métrique, canne à sucre

Evaluación de la calculadora Bonsuco como una herramienta para el análisis comparativo del desempeño sustentable en el sector cañero.

Resumen. Bonsuco fue creado en el año 2008 por un grupo de organizaciones con el fin de apoyar el desempeño sustentable del sector cañero a nivel global. Con ese fin se creó un Estándar métrico que provee a la industria un conjunto de objetivos de sustentabilidad...
Cuantificables. Para permitir una medición consistente en el desempeño Bonsucro creó una calculadora, ésta se basa en la recopilación de un conjunto de datos reales de producción que miden el desempeño de las prácticas sociales, ambientales y técnicas en áreas que van desde actividades agrícolas (ej. rendimiento de la caña), molienda (ej. porcentaje de recuperación del azúcar), impacto social (ej. tasa de accidentes en ingenios y áreas de suministro de caña) y el impacto ambiental (ej., emisiones de GEI). La calculadora de Bonsucro utiliza los datos recopilados para demostrar el desempeño sustentable comparado con umbrales métricos y para otorgar a la unidad de certificación (ingenios y áreas de suministro de caña) con un Certificado de Bonsucro.

Desde su lanzamiento en junio de 2011, 59 Ingenios y áreas de suministro de caña han utilizado la calculadora Bonsucro anualmente. Eso ha proporcionado a Bonsucro más de 50,000 puntos individuales de recolección de datos en hojas de cálculo de Excel. Con el uso de software de visualización, ha sido posible representar los datos de manera agregada para identificar el desempeño individual del productor en relación con el desempeño de todos los ingenios y áreas de suministro certificadas por Bonsucro. En este trabajo, mediante la visualización de datos, se analizan tres ejemplos de evaluación comparativa y la oportunidad de aprender de los mejores desempeños. Teniendo en cuenta los resultados y desafíos identificados en la transferencia de aprendizaje, la conclusión evalúa el posible uso de la calculadora de Bonsucro como herramienta para la gestión y el mejoramiento global de la sustentabilidad en el sector de la caña de azúcar.

**Palabras clave:** Análisis comparativo, desempeño sustentable, Bonsucro, métrica, caña de azúcar