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CONCEPTUAL RESEARCH

Sustainable Procurement: Integrating Classroom Learning with University Sustainability Programs

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ABSTRACT

Organizations are facing increased pressure from various stakeholders to address issues of sustainability, resulting in a growing demand for sustainability education and training. Procurement groups remain the key drivers of many sustainability-related strategies, placing pressure on universities to integrate sustainability concepts into the business curriculum. This article describes a replicable educational model that allows students to learn about sustainable procurement while concurrently promoting sustainability within the university community.

Subject Areas: Supply Chain Management, Content Areas, Teaching using Projects, Teaching Approaches, Environmental Issues, Themes.

INTRODUCTION

Sustainability has increasingly become a topic of interest to organizations and business schools worldwide (Linton, Klassen, & Jayaraman, 2007). While sustainability is involved in all of the core business elements, supply chain management, and more specifically, procurement, is especially important to organizations thus making sustainable procurement equally important to business school programs.

This article describes a model that allows students to learn about sustainable procurement while concurrently promoting sustainability within the university

community. We discuss how this model was designed, developed, and implemented by means of a case study and how MBA students worked with University Procurement Services to address a sustainability challenge facing this organization. The case study describes how all three dimensions of sustainability, economic, environmental and social, are integrated with traditional metrics in the supplier selection process. We present the model for possible implementation in business school programs, whether in part or in its entirety.

We first present a brief literature review on sustainable procurement, followed by the case study from which the model was developed, followed by a detailed description of the model. Finally, we discuss the course outcomes, explore the challenges in developing and sustaining the course, and provide future recommendations for creating such a course.

LITERATURE REVIEW

We provide a brief literature review of sustainable procurement research and scholarship. First, we review the current sustainable procurement research and investigate its role within industry. We then consider sustainable procurement scholarship and the current approaches to education and knowledge transfer of this topic.

Sustainable Procurement Research

As organizations move to a more proactive stance in addressing sustainability, there has been an increased focus on supplier selection and alignment of the sustainability goals of an organization with existing economic and performance goals. Because the materials and services selected will have a direct effect on an organization's subsequent processes and outputs (Zsidisin & Siferd, 2001), organizations have had to reassess their procurement strategies (Bowen, Cousins, Lamming, & Farukt, 2001) and integrate environmental considerations into the procurement process.

The majority of the sustainable procurement literature is based on research from private sector manufacturing (Handfield, Walton, Seegers, & Melnyk, 1997; Min & Galle, 1997; Rao & Holt, 2005; Zhu, Sarkis, & Lai, 2007) and suggests that organizations should determine the full environmental impact when evaluating products and services. This requires that procurement professionals look at the entire life cycle of products using either Life Cycle Analysis (LCA) models (Carter & Carter, 1998; Carter, Ellram, & Ready, 1998; Foran, Lenzen, Dey, & Bilek, 2005; H'Mida & Lakhal, 2007; Klassen & McLaughlin, 1993), equilibrium models (Cruz, 2008, 2009; Hsueh & Chang, 2008), multi-criteria decision making models (MCDM) (Cruz, 2009; Frota Neto, Bloemhof-Ruwaard, van Nunen, & van Heck, 2008; Hugo & Pistikopoulos, 2005), or analytical hierarchy processes (AHP) (Bai & Sarkis, 2010; Lin & Juang, 2008; Sarkis, 1998, 2003). The majority of these methodologies remain complex and resource dependent (Zsidisin & Siferd, 2001), requiring organizations to have capable resources.

Integrating sustainability into the procurement process requires conceptualizing sustainability along three widely accepted dimensions (Carter & Easton, 2011; Seuring, 2012): economic (Seuring, 2012), environmental (Preuss, 2005), and

social (Seuring & Muller, 2008). The majority of sustainable procurement research tends to focus solely on the (quantifiable) environmental dimension of sustainability (Matos & Hall, 2007), relying on environmental certification methodologies to provide formal guidelines for environmental adoption (Noci, 1997), with the social dimension rarely mentioned in the literature (Seuring, 2012) since it is often difficult to quantify social measures.

Sustainable Procurement Scholarship

There is an increasing call for interaction between academia and practitioners to further develop knowledge of sustainable procurement (Walker & Brammer, 2009; Wright, 2002). The ongoing adoption of sustainability by procurement organizations will necessitate that this knowledge be provided to future generations of procurement professionals in academia.

Partnerships between academia and industry can teach and implement concepts of sustainable procurement and potentially have a transformative effect on procurement organizations as well as improve educational experience through practical engagement (Gustavs & Clegg, 2005). Unfortunately, because of internal barriers within organizations, it can often be difficult to develop successful partnerships, which require continuous engagement and management (Walker & Brammer, 2009). To avoid this concern, Maloni and Paul (Maloni & Paul, 2011) describe a partnership in which operations management students engage with the university sustainability office to develop a 20-year greenhouse gas emissions forecast, developing individual, collective, and organizational learning on the topic of sustainability. We believe there are many sustainability project opportunities within the university community, providing mutual benefit to both the scholar and the university (Maloni & Paul, 2011).

We have identified two clear research gaps that challenge the foundation and instruction of sustainable procurement: (1) the challenge of collecting data from an often broad, lengthy and diverse supply chain when evaluating a product or service and (2) the challenge of integrating social dimensions of sustainability into the supplier evaluation and selection process. This research further discusses these challenges, providing a case study illustrating these challenges and proposing a framework and model to address them.

CASE STUDY

The case study was developed as a result of a project with the procurement services department (PSD) at the Pennsylvania State University, and entailed developing a methodology to integrate sustainability criteria into the organization's purchasing decisions. While the PSD had occasionally incorporated environmental attributes into purchasing decisions, these decisions were mostly determined by the environmental/cost tradeoffs. This circumstance, however, was not the case with janitorial paper products (tissues, toilet paper, paper towels, etc.): in 2008 the PSD was in the last year of its contract with Kimberly-Clark (K-C) and was facing pressure from an environmental student action group, Eco-Action (E-A), to source from a new supplier.

E-A was staging protests throughout campus (Burnham, 2008) as part of the Kleercut campaign, regarding the “low amount of recycled content in K-C products and K-C’s use of 100-percent virgin pulp for its Kleenex brand tissues” (Paturzo, 2008). During ongoing meetings with the PSD, E-A continued to express its opposition to K-C, requesting that a suitable, alternative supplier be found.

Concurrent to the start of the Kleercut campaign on campus, a group of MBA students from the Net Impact student organization (NI) approached the PSD and offered MBA student resources as a way to promote social responsibility at the university. A working relationship quickly developed between NI and the PSD, and the first project for NI was to assist with the tissue paper supplier selection process for the university. The PSD had agreed to investigate other suppliers for the tissue paper contract, but this was the first time that the PSD was asked to evaluate suppliers beyond economic and simple environmental metrics, including nonquantitative sustainability metrics.

Following the initial meetings between the PSD and NI, the project was officially established as an independent study course offered to MBA students, with eight students participating along with two faculty advisors. The MBA course students (MBA) had little experience with sustainable purchasing but were committed to developing a solution for the PSD. To initiate the project, the MBA students held meetings with the various stakeholders involved in the process, including the PSD, E-A, and facilities services (FS) to develop an understanding of each stakeholder’s desire for the tissue paper supplier. From these meetings it became clear that each stakeholder had a different set of criteria that was important. It was also evident that while each of the stakeholders understood its own constraints quite well, there was little knowledge of the other stakeholders’ points of view.

PSD was sensitive to cost and preferred to source from local and minority-owned businesses, but also required that any procured product work within the existing infrastructure of dispensers in place throughout the university. E-A sought to have the most environmentally “friendly” products but was especially sensitive to where the paper fiber used in the products was sourced from, requesting that no products from the supplier’s entire product portfolio be produced from old growth forests. FS required that the products meet the performance and durability expectations of their employees, who would be working with the products on a daily basis.

Due to the unfamiliarity with the sustainability attributes, the MBA team initially focused on developing a set of criteria that could be used to evaluate the tissue paper suppliers. The available literature suggested that a LCA of the tissue paper products be performed to evaluate the environmental attributes. It quickly became apparent though that conducting the LCA would be too time and resource intensive for the scope of the project.

An alternative to the LCA was to have the suppliers utilize existing environmental certifications such as Green Seal (Green Seal) or Environmental Product Declarations (EPD). The University of Vermont, at the time the most recent university to remove K-C products from its campus, replaced K-C with a local Green Seal certified company, Cascades Inc. E-A’s proposal to the PSD was to utilize a supplier that had Green Seal certification (Wilson, 2009a), but upon investigating a number of Green Seal certified paper companies, it was found that there was

uncertainty as to whether any of these potential suppliers would be feasible because of the significant additional costs to the product, as well as uncertainty about these suppliers meeting the PSD's quantity requirements.

An alternative was needed that would enable the evaluation of sustainability criteria for a wide range of supplier candidates. The MBA team determined that a simple framework, utilizing less time and fewer resources and incorporating sustainability criteria into traditional purchasing decisions, did not exist and would need to be developed. Additionally, it was necessary that the framework be able to compare large multinational producers with small local distributors on all measures, including sustainability criteria.

The MBA team began developing a set of sustainability criteria to be included in the analysis, which allowed for the equitable and objective comparison of all suppliers. However, this task proved to be difficult because of the team's unfamiliarity with the tissue paper industry and the environmental and social impacts associated with the production process. To facilitate the framework, the team utilized tissue paper guidelines documented by the Environmental Protection Agency (EPA) as a foundation for the supplier sustainability criteria. Additional criteria for the analysis were developed from existing environmental certification schemes, integrating some of the environmental criteria from these certifications into the PSD sustainability framework. Lastly, input from the stakeholders involved in the process also contributed to the PSD sustainability criteria, including the requirement that no fiber be sourced from old growth forests and that the supplier use a forestry certification program for wood pulp in its products.

The establishment of a set of sustainability criteria that included both quantitative and qualitative measures allowed the MBA team to evaluate suppliers using a two-stage evaluation process. During the first stage each supplier was evaluated according to whether it met the minimum established threshold for each criterion: for example, whether the tissue paper products met the minimum for post-consumer recycled content. If any supplier could not meet the minimum thresholds for each of the criteria, then it would not be considered further in the evaluation process. Once the suppliers were qualified by meeting the minimum threshold of all criteria, a weighted score and ranking model would be used to further evaluate the qualified suppliers and a final selection would be made for the tissue paper contract.

At the culmination of the 8-week course, the framework and process were presented at a meeting with all of the stakeholders present (Wilson, 2009b), including PSD, FS, E-A, as well as a number of the suppliers being considered for the contract. The PSD and FS members present were happy with the proposed model because of the ease with which the PSD could integrate the framework into their existing operations: "From our standpoint, it is something that we can manage and it is not subjective" (Wilson, 2009b).

Unfortunately, E-A objected to three of the points: the framework only established the EPA requirements as a minimum requirement, it allowed suppliers to use either of the major forestry certification programs, and it only analyzed products being sourced by the university and not the company's entire product portfolio. These objections by E-A were later dismissed as K-C adopted the forest certification scheme supported by E-A (and the Kleercut campaign sponsoring organization—Greenpeace).

The PSD ultimately utilized the proposed framework to qualify a set of suppliers for the janitorial contract, taking into account environmental considerations, including recycled paper content, packaging, and raw material forest sourcing and certification; social considerations, including whether they were minority-owned businesses and/or a local businesses; and economic considerations, including product costs. All of these requirements, along with the traditional factors of cost and quality, were ultimately considered and evaluated to determine which suppliers met all the criteria.

In the fall of 2009, K-C reached an agreement with Greenpeace to work together to improve the company's environmental standards, thus ending the Kleercut campaign (Stern, 2009). K-C's change in environmental standards allowed them to remain in consideration for the tissue paper contract, and ultimately, a local distributor won the contract to supply K-C tissue paper products to the university.

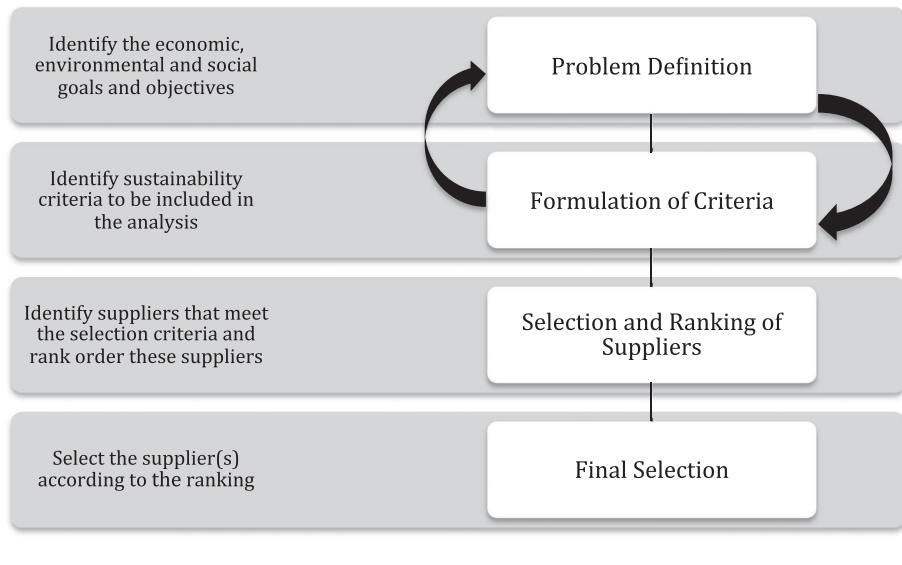
The adoption of this framework by the PSD ultimately led to the sourcing of more sustainable tissue paper products by the university and ensured that none of the products were produced from pulp sourced from old growth forests. In addition, the framework was presented to the national Net Impact organization, resulting in members from other schools contacting the Penn State chapter for advice on how to develop sustainable consulting projects at their university campuses.

Following the janitorial paper project, the PSD continued to engage with NI and the MBA program to assist PSD with other sustainable procurement projects. This partnership has resulted in an ongoing relationship where students gain first-hand experience in sustainability projects, the PSD is able to make informed decisions based on the student led research, and the university continues to become a greener community.

SUSTAINABLE PROCUREMENT MODEL

This course was offered as a practicum within the MBA program at the Pennsylvania State University and was limited to a maximum of 16 students. The practicum took place over a full 16-week semester, with students meeting weekly for a period of two hours to evaluate progress, identify challenges and discuss project development. The students identified four critical aspects of the sustainable procurement project and divided into four teams of four students, with each team addressing a specific aspect of the project. The student teams were tasked with establishing ongoing meetings with the various external stakeholders involved in the project and asked to involve all stakeholders in progress reports. In the final month of the class, the student teams worked together to develop a project report, which was presented at an open session during the last class of the semester.

Below is the model that was developed during this practicum and which has served as the foundational process utilized in subsequent sustainable procurement projects. The sustainable procurement model offers a perspective on how to develop and implement sustainable purchasing initiatives within the classroom environment, but the model can be adapted by educators to suit their own requirements. The model is comprised of four phases as illustrated in Figure 1: definition of problem, formulation of criteria, selection and ranking of suppliers, and

Figure 1: Sustainable supplier selection process.

final selection of supplier(s). These phases in the supplier selection literature are conventional (De Boer, Labro, & Morlacchi, 2001; Demirtas & Ustun, 2009; Gencer & Gürpınar, 2007; Liao & Rittscher, 2007; Talluri & Narasimhan, 2004).

Problem Definition

In the problem definition phase, goals and objectives of the project are identified in conjunction with the partnering organization. These goals and objectives should reflect the purchasing organization's ultimate strategy and objective – determining what is important to the organization and why a specific supplier(s) should be selected (Vokurka, Choobineh, & Vadi, 1996). It is important to collect input from all stakeholders involved (who often have conflicting interests) to ensure that the problem is clearly understood from the perspective of all parties involved. As this stage sets the groundwork for the rest of the process, it is important to have a focused attention to detail, thereby eliminating potential concerns or conflict during later stages of the process.

In the janitorial paper products example there were multiple stakeholders who were involved in the problem definition stage, including the procurement services group, a student-led environmental activist group, and the FS department. Representatives from each group met multiple times to discuss the goals and objectives of the janitorial paper sourcing decision. These meetings enabled each of the stakeholders to present their requests and inform the other stakeholders of the reasoning behind these requests. This forum process facilitated the establishment of the goals and objectives to move forward in the process.

Formulation of Criteria

After determining the goals and objectives, the formulation of criteria phase identifies all of the measures to be included in the analysis, including sustainability metrics. Typically, most sustainability studies formulate solely environmental criteria, utilizing the LCA as a starting point for the analysis. While certain measures have become common in the formulation of sustainability criteria (e.g., CO₂ emissions), there is a wide range of rather complex sustainability criteria that require a deeper understanding for evaluation. This is also often the case with the social dimension of sustainability, where it is often difficult (if not impossible) to assess the measures.

As the complexity of the criteria increases, the formulation of a set of agreed upon sustainability criteria might also need to involve discussions with potential suppliers in order to ensure that the measures are established in such a way that certain metrics can be tracked and reported. Potential suppliers may not have processes in place for measuring or evaluating all of the proposed sustainability criteria, especially as new concerns of sustainability arise. Should this be the case, the goals and objectives stage should be revisited and these issues discussed among all parties. Therefore, establishing a set of sustainability criteria often requires an iterative review of the problem definition and criteria formulation.

Identifying sustainability criteria could be further complicated by the fact that the appropriate measures may be unknown. If this is the case, it is recommended to use reference material to help establish the appropriate sustainability criteria. This is the situation that arose with the janitorial paper case regarding the bleaching process (Chlorine, Elementary Chlorine Free [ECF], and Total Chlorine Free [TCF]). However, there was documentation available from the EPA to help guide the team in establishing the appropriate criteria.

While these secondary resources can provide guidance in the appropriate criteria to include in the analysis, it is recommended to review these criteria (and the source of the criteria) with the stakeholders to ensure that the recommendations are impartial and acceptable. We found it difficult to find unbiased information regarding the sourcing and certification of the wood pulp, making this stage the most difficult and time-consuming in the entire process.

Selection and Ranking of Suppliers

Only after the criteria have been finalized can the selection and ranking of suppliers phase take place. Numerous models have been developed for the supplier selection process: the most common modeling approaches regarding sustainable procurement are LCA, Equilibrium models, MCDM, and AHP. While each of these models has its strengths and weaknesses, we believe that the model that is most appropriate for the particular assessment should be adopted.

While LCAs are the most common environmental assessment tool, they often do not include social dimensions of sustainability and require in-depth studies along a supply chain. Equilibrium models typically have been adopted to balance environmental and economic factors to find an optimal solution, but these, as well, do not account for social dimensions of sustainability. MCDM models have been applied to optimize both economic and environmental criteria, identifying optimal

solutions, but again these models have difficulty in accounting for social criteria, which is often qualitative in nature. Lastly, AHP uses a decision-making process, obtaining a solution based on semi-quantitative criteria and respective weights.

In the case of the janitorial paper analysis, AHP was deemed to be the most appropriate model to use because (1) it allowed for several criteria to be evaluated with the scope of the decision problem, (2) it allowed both quantitative and qualitative criteria to be considered in the decision problem, (3) it enabled the model to include the influence of the decision maker, and (4) it simplified the decision making process. As AHP was the structure that was used in the case study, we will continue with a more detailed description of this process. Again, we reiterate that it is up to the users' discretion as to which model is most appropriate for their purpose. They should also refer to Seuring (2012) for a more thorough review of these modeling approaches.

The first step in this stage of the developed model is to establish a set of suppliers that meet the minimum set of requirements-supplier qualification. Given a set of sustainability indicators, i , for each supplier, j , $X = \{x_{ij}\}$, $i = 1, 2, \dots, I$, and $j = 1, 2, \dots, J$, a supplier is only qualified if each sustainability indicator for a given supplier x_{ij} is greater than the established minimum sustainability standards

$$S = \{s_i\}, \quad i = 1, 2, \dots, I$$

$$x_{ij} \geq s_i \tag{1}$$

These qualitative and quantitative sustainability criteria are minimum targets, which a supplier must meet in order to be considered for further evaluation. These targets are not static in nature (especially regarding sustainability) and often require continuous evaluation and modification over time (Rosenthal, 1985).

Final Supplier Selection

After the set of qualified suppliers has been established, the set of indicator variables are standardized. While this step is not necessary, we found it helpful in differentiating the performance of the various suppliers with each of the sustainability criteria and later in discussing these criteria with the procurement services staff. While there are many different normalization techniques, we use the distance from the best and worst performers as the key metric, in which the position of each supplier is established in relation to the global maximum and minimum for each indicator, with the index taking values between 0 (worst) and 100 (best).

$$y_{ij} = \frac{(x_{ij} - \min x_i)}{(\max x_i - \min x_i)} \tag{2}$$

Lastly, weights are utilized to calculate a composite score for each supplier under consideration. The weights for each of the metrics are determined by the procurement organization and should reflect the priorities and importance of each metric. This composite score objectively evaluates each supplier under consideration in the supplier selection process. The weighted scoring model is formulated

mathematically as:

$$\begin{aligned} & \max \sum_i w_i y_{ij} \\ & \text{subject to } \sum_i w_i = 1 \\ & \text{and } 0 < w_i < 1 \end{aligned} \quad (3)$$

The proposed supplier selection model involves multiple noncommensurate objectives and thus a multi-criteria optimization technique is employed in the solution methodology. The result of this optimization model is a set of nondominated solutions, where it is impossible to improve the value of one objective without diminishing the value of another objective.

Weighted scoring models encounter serious theoretical objections due to the fact that the weights should not be considered constant and should be allowed to vary with x_i (Rosenthal, 1985). Issues of sustainability are often subject to diminishing marginal returns, meaning that as investment continues to increase, it will have decreasing impact. This is often the case with environmental criteria such as carbon output: as firms continue to invest in ways to reduce carbon, the impact of these investments will continue to decrease over time.

While there are reasonable shortcomings of the proposed weighted scoring model, we believe that the simplicity and ease of use of this model for its intended purpose outweigh its shortcomings. Faculty looking to adopt similar sustainable procurement projects within their own institutions should use whatever supplier selection methodology they feel comfortable with and which can easily be conveyed to and adopted by the partnering procurement organization.

COURSE OUTCOMES AND CHALLENGES

This MBA procurement practicum presents a model for higher education institutions to adopt in order to educate students about sustainable procurement and, at the same time, to benefit the university community. This model allows for the consideration of all three dimensions of sustainability, integrating economic, environmental and social concerns into the supplier selection process and can manage both quantitative and qualitative measures.

Other universities seeking to integrate collaborative sustainability programs within their curriculum can easily replicate this model. This model requires little previous sustainability experience, eliminating the complexities associated with existing assessment tools, so the proposed framework is manageable for introductory sustainable procurement programs.

This model was successfully adopted for use in MBA procurement practicum courses, which also involved the partnership with the purchasing services department. We believe that this model is robust enough to provide a foundation for any similar academic program and is flexible enough for application in a wide range of projects.

In addition, the purchasing services department was able to easily adopt and integrate the framework into their existing purchasing process. Following the first

use of the model for the janitorial tissue paper, the PSD has continued to use this model in supplier selection, further integrating sustainability into the selection of many goods sourced by the university.

While this model is intended to teach students about sustainable procurement, it is not intended to replace existing (and often more thorough) sustainability assessment methodologies. It is intended to be a first step in understanding the complexities of integrating sustainability into business. While we recognize the limitations of the model's functionality, we also believe that the simplicity and efficiency of the model allow it to be implemented over the course of a semester, outweighing its accepted shortcomings.

This research provides higher education institutions with an adoptable and adaptable model to integrate sustainable procurement education and application into a business curriculum. Though this model was developed and intended for MBA students, we believe that with a greater level of faculty involvement, the model could also be implemented at the undergraduate level, although this has not been pursued as of yet.

Finally, this model is a way to introduce and address all issues of sustainability to students. This is a key differentiator of this model, and one we believe to be increasingly important, as factors such as child labor (Murphy & Mathew, 2001), fair trade (Vogel, 2005), conflict minerals (Prendergast, 2009), etc. become relevant in procurement decisions.

CONCLUDING REMARKS

Organizations are facing increased pressure from various stakeholders to address issues of sustainability, resulting in a growing demand for sustainability education and training. Procurement organizations remain the key drivers of many sustainability-related strategies, placing pressure on universities to integrate sustainability concepts into the business curriculum. Academic institutions should look internally to develop projects in which students can engage in sustainable procurement decisions.

The Pennsylvania State University purchasing services department was faced with the challenge of integrating sustainability into their purchasing processes and looked internally for assistance in incorporating sustainability in purchasing decisions. From the partnership that was established with procurement services, the MBA program developed a sustainability practicum to assist purchasing services and to integrate practical knowledge and experience with sustainability for its students. This article presents the model that was developed from the initial MBA project and how it has been adapted and adopted both within the Pennsylvania State University and at other leading educational institutions.

The framework presented in this article is an adaptation of the conventionally accepted supplier selection framework, including formulation of criteria, selection and ranking of suppliers, and final selection of supplier. We describe in detail how each of these phases has been updated to ensure the inclusion of all three sustainability dimensions. Most notably, we include the social dimension, which is rarely addressed in practice and research, but continues to increase in importance. To ensure that social criteria play a prominent role in procurement decisions,

we adopt a hybrid model for simplifying and structuring supplier evaluation and selection decisions. We justify the use of this model because it allows for the evaluation of complex decisions while fulfilling the two additional requirements necessary of the model: it allows for the inclusion of qualitative data, and it is easy to implement and manage by nontechnical experts.

We believe that the proposed model is simple, requiring minimal knowledge and expertise from the students, minimal monetary investment, and nominal time to complete over the course of a semester. We also believe that the model is comprehensive as it incorporates all three dimensions of sustainability: economic, environmental, and social responsibility, and allows for the integration of qualitative and quantitative sustainability criteria in the supplier selection process. For these reasons, this model is flexible enough to handle a variety of projects within any university community.

Our model introduces the concept of sustainable procurement to students, and it engages them with real-world sustainability projects. As a result, students not only gain knowledge about sustainable procurement, but they also gain experience in improving sustainability in their own university community.

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