Building Sustainable Markets: Overcoming Barriers to Recycled Materials Futures Contracts

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ABSTRACT Incorporating sustainability into business practices is critical for addressing contemporary environmental challenges. One promising avenue is the development of a futures market for recycled materials, which could stabilize price volatility, enhance market transparency, and incentivize businesses to incorporate recycled material into their products. This case study examines the barriers to establishing such a futures market, and the potential opportunities this market would present for integrating environmental and business objectives. Using semi-structured interviews with industry stakeholders—including recycling executives, environmental, social, and governance managers, and regulators—this study identifies key obstacles such as regulatory uncertainty, market liquidity concerns, and skepticism about the financial viability of futures contracts for recycled materials. The findings illustrate how market mechanisms could alleviate such challenges, offering insights into the design of financial instruments and the integration of sustainability considerations into business decision-making. Practical implications are also discussed, highlighting how businesses can use the futures market to mitigate risks, align with environmental policies, and appeal to eco-conscious consumers. This case study is designed for classroom use in courses on sustainability management, environmental policy, finance, and business strategy, with a focus on fostering critical thinking about market-based environmental solutions. KEYWORDS recycling, sustainability, financial innovation, derivatives, market participation

CASE CONTEXT

The global recycling industry faces persistent challenges in achieving environmental and economic sustainability. Despite widespread efforts to promote recycling, markets for recycled materials often suffer from inefficiencies, including price volatility, inconsistent quality, and unreliable supply chains. These inefficiencies are exacerbated by competition from virgin materials, which tend to have more stable pricing and greater availability. Such conditions discourage businesses from fully committing to recycled materials, undermining progress toward a circular economy (Moore et al., 2022).

A futures market for recycled materials offers a potential solution by providing price stability and greater transparency. Futures contracts, commonly used in markets for commodities like oil and metals, allow businesses to lock in prices and hedge against market fluctuations. Applying this approach to recycled materials could incentivize greater investment in recycling infrastructure and create a more robust supply chain for secondary materials. Additionally, such a market aligns with broader sustainability goals, such as reducing waste, conserving natural resources, and lowering greenhouse gas emissions.

This case study explores the feasibility of establishing a recycled materials futures market in the United States by examining barriers to its implementation and identifying opportunities to integrate sustainability into business practices. Using insights from industry stakeholders—including corporate executives, environmental, social, and governance (ESG) managers, and policymakers—this study provides a roadmap for addressing the dual objectives of environmental and economic sustainability. The findings are particularly relevant for businesses seeking to mitigate risks while contributing to global sustainability goals, offering lessons that can be applied across multiple industries.

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Background: What's a Futures Contract?

A futures contract is a simple financial agreement between two parties to buy or sell something at a set price on a specific future date. Imagine a farmer and a bakery making a deal for wheat: the farmer promises to deliver the wheat 6 months from now, and the bakery agrees to pay a fixed price when it's delivered. This arrangement helps both sides. The farmer knows they'll get paid a certain price regardless of market changes, and the bakery can plan its costs without worrying about sudden price increases for a key ingredient. Futures contracts are commonly used for commodities like wheat, oil, or metals to bring stability to markets where prices can swing wildly. Currently, there are no futures contracts for recycled materials available in the United States; however, futures contracts are very common for all sorts of virgin materials like aluminum and plastic resin.

For the recycling industry, futures contracts could help solve a big problem: unpredictable prices. The cost of recycled materials like plastics, paper, and metals can rise and fall due to supply shortages, changing demand, or competition from new, cheaper materials. These price swings make it harder for businesses to commit to using recycled materials in their products. Futures contracts could help by allowing businesses to lock in a price for these materials ahead of time. That way, they know what they'll pay, even if market prices spike, making recycled materials a more reliable and financially stable choice. On the other side, firms providing recycled material would be assured of prices they could earn, protecting them if market prices collapse.

A futures market for recycled materials could also improve trust and consistency across the industry. To trade futures contracts, everyone involved must agree on clear definitions and quality standards for the materials being bought and sold. This creates more confidence for buyers and sellers alike. It also makes the market more transparent, helping companies plan better and make smarter decisions about the materials used in their products. Over time, this kind of system could boost demand for recycled materials, reduce waste, and support global initiatives seeking to implement more environmentally friendly business practices.

The State of Recycling in the United States

Consumer pressure on firms to improve sustainability performance has increased, with a focus on incorporating recycled materials into new products. Brands increasingly seek to incorporate sustainability and recycling initiatives into products and marketing communications to enhance brand value and appeal to environmentally conscious consumers. There is also rising regulatory pressure on firms to use recycled materials, as U.S. states including New Jersey, Washington, and California are developing and implementing recycled content mandates and extended producer responsibility (EPR) laws (Heffernan, 2023).

However, the market mechanisms for buying and selling recycled materials are unreliable and unable to match supply and demand at the required scale. This is evident from the large volume of recycled material that goes to landfill instead into new products and materials. The United States Environmental Protection Agency (USEPA) reported that 48.2% of the 292.4m tons of municipal solid waste generated in the United States in 2018 was recyclable: paper (23.05% of total waste), plastic (12.20%), metal (8.76%), or glass (4.19%). Yet only 69m tons of material were recycled, 48.9% of the eligible material, including 45.95m tons of paper (68.18% of paper disposed), 3.02m tons of plastic (8.47% of plastic disposed), 8.71m tons of metals (34.0% of metals disposed), and 3.06m tons of glass (24.98% of glass disposed; all figures USEPA, 2020). About half of recyclable material ends up in a landfill, incinerator, or illegal dump site. One of the most prominent global studies of plastics recycling notes:

> *As of 2015, approximately 6300 Mt of plastic waste had been generated [since the first plastic products were released in the market], around 9% of which had been recycled, 12% was incinerated, and 79% was accumulated in landfills or the natural environment. If current production and waste management trends continue, roughly 12,000 Mt of plastic waste will be in landfills or in the natural environment by 2050. (Geyer et al., 2017)*

The problem of wasted supply feeds into the problem of unmet demand. Many large buyers of recycled material cannot secure an adequate supply for their manufacturing processes. For instance, both Coca-Cola and PepsiCo, the two largest drinks companies, have committed to increasing the recycled content of their bottles, but have pointed out tremendous difficulties in securing adequate supplies of recycled plastic (DeSocio, 2021). Collection problems have contributed to volatility in quantity and price of materials like plastic, glass, paper, and corrugated cardboard,

which has negatively impacted the ability of large manufacturers and retailers to plan for flows of material and incorporate recycled content into new products (Moore et al., 2022).

The result is a negative feedback loop. For instance, one participant in a keynote panel at the 2022 Association of Plastics Recyclers event noted, "The U.S will need to double collection of most plastic resin types to meet the projected demand for products with a 25% recycled content composition, and ... estimated collection for most resins will need to triple to be able to supply enough to meet 50% PCR [post-consumer recycled content] goals" (Quinn, 2022a). Meanwhile, sellers of recycled material have also struggled, given high price volatility and companies' willingness to continue purchasing more predictable "virgin" materials. Kate Davenport, the co-president of Eureka Recycling, a nonprofit materials recovery facility ("MRF") operator in Minneapolis, noted, "brands ... called me and asked for [recycled] content, then disappeared three months later" when prices shifted (Quinn, 2022a). One industry media summary of the event observed, "the topic of recycled resin price and availability came up numerous times throughout the conference, including from brand owners mentioning the need to source more recycled plastic to meet their sustainability goals and processors seeking funding or resources to better collect and process the material" (Quinn, 2022b).

The excess volume of recyclable material headed for disposal, but severe supply shortage among firms who want to buy it, suggests failure to connect buyers and sellers in America's recycling markets. Much of this market failure is attributable to the current structure of the recycled materials market itself. First, the supply chain of moving material collected from homes and businesses to processors to end users making new products is different from typical commodity flows. Most commodities trade on centralized markets with clear mechanisms for reporting prices and volumes. In contrast, recycled materials are traded largely "over the counter" (OTC) through personal and professional networks of processors, brokers, buyers, and sellers. It can be difficult to match buyers and sellers since one party may not know about the other. Scholarly finance literature is quite clear about the numerous drawbacks of OTC trading. Illiquidity associated with search and bargaining affects intermediation and asset prices in OTC markets (Duffie et al., 2005). Additionally, OTC markets are largely unregulated, involving counterparty risk and facilitating speculation (Stulz, 2010).

Established futures markets set parameters for the quality and quantity of commodities listed for trading, while similar parameters for recycled materials are at best suggestions made by industry associations. The recycling industry has long suffered from quality and contamination issues, and contamination was one of the motivating factors behind the Chinese government's 2019 ban on importing U.S.-collected recycled materials (Heiges & O'Neill, 2022). Tales of unscrupulous vendors mixing different grades of material, even marketing trash as recycled material, are common in the industry (Howell, 2023). Accordingly, firms may only be willing to purchase from vendors known to meet quality standards, effectively shrinking the marketplace and spurring volatility in price, availability, and quality of recycled material. Large industrial users instead turn to new materials, while recyclables from smaller or lesser-known sellers head to landfills or incinerators. Standardized contracts, like those associated with all other types of commodity futures, would correct this issue by requiring standards and imposing penalties on market participants who fail those standards. By offering transparency and enforcing standardized quality parameters, futures markets could address contamination issues and ensure reliability for both buyers and sellers.

The theoretical potential for derivatives like futures contracts to improve markets for recycled material has been well-demonstrated in a previous study (Moore et al., 2022). But would actors in the recycling industry actually use such a market? Although financial innovations can improve economic outcomes for market participants, it's not automatic that stakeholders will participate. Research examining human factors that make markets function reveals the importance of carefully understanding the social structure of markets. Factors like trust, personal networks, technological embeddedness, and narrative impact the construction and operation of any market (Carruthers & Stinchcombe, 1999; Knorr-Cetina & Preda, 2004; Knorr-Cetina & Preda, 2012; Roscoe, 2023). A company looking to buy or sell recycled material through a futures market would be getting into something quite different than their core expertise. This case study seeks to understand whether a futures market for recycled materials could address these issues and, crucially, what factors might encourage or discourage stakeholders from participating in such a market.

Table 1. Interview Participant Characteristics.

Participant Characteristics	Details
Total participants	13
Gender distribution	11 Men, 2 women
Sector involvement	Derivatives and commodities: 5
	Waste and recycling: 4
	State-level environmental regulatory: 2
	Research and media in waste/ Recycling: 2
Roles in waste/Recycling sector	Industry association representatives: 2
	post consumer materials processing and sales: 2
Senior/Executive roles	9

CASE METHODOLOGY

Analysis of the types of futures contracts available on major exchanges today illustrates numerous ways to build and organize derivatives markets and several models for commodities contracts. There are many options to consider in both market/exchange design and contract design, among other factors that would determine a firm's willingness to participate in a new market (see the companion case study by Moore & Howell, in press). This case study investigates the feasibility of establishing a futures market for recycled materials by analyzing barriers to implementation and identifying opportunities to align such a market with sustainability and business objectives. To achieve this, we employed a qualitative research approach, collecting data through semi-structured interviews with a diverse group of stakeholders in the recycling industry. These stakeholders included corporate executives, ESG managers, policymakers, and industry association representatives. Summary information about interview participants appears in table 1, and the interview questions are included in Appendix 1.

The interview questions were prepared by the authors, based on our expertise and knowledge of the recycling industry. The semi-structured interview format allowed participants to discuss their experiences, perceptions, and concerns regarding the potential adoption of futures contracts for recycled materials. This approach facilitated in-depth exploration of key themes, including market barriers, regulatory challenges, and the potential benefits of standardized trading mechanisms. The interviews were conducted by the authors of this case over a 3-month period and were recorded, transcribed, and coded for analysis using thematic coding techniques. This process identified recurring patterns and insights relevant to market development and stakeholder participation.

To complement this qualitative data, we reviewed industry reports, policy documents, and relevant academic literature. This triangulation provided additional context for understanding the systemic issues faced by the recycling industry and helped validate the themes emerging from the interviews. The combined data were used to construct a framework for addressing market inefficiencies and designing a futures market tailored to the needs of the recycling sector, the mechanics of which we discuss in the companion case (Moore & Howell, in press). By integrating these perspectives, the research methods not only identify barriers and solutions but also offers a roadmap for leveraging market mechanisms to achieve environmental and economic sustainability goals around recycling.

CASE EXAMINATION

Major concerns regarding contract, market, and exchange design that were raised by interview participants, as well as their additional observations about the potential for a post consumer materials (PCM) derivatives exchange, are offered below. In reviewing the sentiment of participants' responses, meaningful categories naturally emerged. The percentage of participants that raised an issue is also noted, indicating the extent that a particular concern cut across the different stakeholder categories the participants represented.

Data saturation in the context of stakeholder interviews is a crucial concept in qualitative research, particularly in ensuring the comprehensiveness and depth of the data collected. At some point, new information ceases to emerge from the interviews, indicating that theoretical categories are well-developed and that further interviews are unlikely to yield substantially new insights (Saunders et al., 2017). Given the content of the interviews and the similar responses that emerged from our participants, we are confident that data saturation has been achieved with the study.

Four major themes emerged from the interviews.

1. The "Business Case": Managing Both Price Volatility and Contamination

100% of interview participants identified a business case for participation in a recycled materials derivatives market. All interview participants identified price volatility as a reason why firms should want to transact recycled

materials using derivatives on a centralized exchange. Some prices for recycled material are correlated with broader economic conditions (e.g., office paper), while others are more closely tied to the prices for their "virgin material" equivalent (e.g., #1, #2, and #5 plastic). In any event, price volatility is a considerable risk for industry firms, whether they are sell-side (processors and brokers) or buy-side (end users looking to incorporate recycled materials). One interview participant, a former executive at a major U.S. fast food chain and current consultant on commodities risk management, explained:

> *Many restaurants have substantial food price risk . . . [for instance a restaurant chain that] offers a dollar menu and invests millions of dollars into advertising it, customers expect to purchase a double cheeseburger for US$1, and if the price of the ingredients for a double cheeseburger goes from 39 cents to 49 cents, [the chain] can't just take the item off the menu, and they can't start charging US$1.10. I work with firms that have this kind of commodity price risk to determine an optimal hedging strategy . . . The optimal hedging strategy depends on the degree to which a particular firm can pass costs onto customers.*

For the recycling industry, buy-side firms would need to determine customer willingness to pay higher costs for products containing recycled content, but sell-side firms would also benefit from greater price certainty. Participants noted that given the boom-and-bust nature of recycling markets, derivatives could assist firms estimating costs and budgeting capital expenditures.

Conversely, 3 of 13 participants observed that while any firm transacting recycled materials seeks greater price certainty, large firms on both the buy-side and sell-side, particularly major vertically integrated waste management firms, might choose to ignore any new futures markets. For these firms, participation could result in *worse* prices than what they might negotiate directly with trading partners. Through trade and transaction data moving through a centralized exchange, these firms could inadvertently divulge something about their operations or supply chain. In other instances, as a former CEO of a major paper fiber recycler and packaging manufacturer observed, many large retailers in the United States already created multiyear forward agreements for recyclable materials like corrugated cardboard boxes. While these contracts offer the same price stability to the firms involved as futures contracts, they do not supply the same type of price and volume information to the broader market as futures would.

Nine of 13 interview participants—all the participants active in the recycling industry—agreed that an exchange utilizing standardized contracts would immediately decrease contamination rates, addressing a major challenge in the recycling industry. One participant observed that in a recent consulting opportunity, the client municipality reported a contamination rate above 40%. Even though material had been collected and taken to a processing facility, it was unsellable due to mixture with nonrecyclable material, food waste, grease, and so on. Currently, unscrupulous firms might market such material as "clean" recycled material anyway, causing issues for subsequent buyers. However, on an exchange with clear rules for commodity quality and strict penalties for noncompliance, the supply of recycled material would potentially become much cleaner. This issue was particularly important to interview participants representing two regulatory stakeholders and two recycling industry associations.

2. Commodity Type and the Potential for Success

All interview participants articulated that choice of underlying commodity would be critically important to the success of a recycled materials futures market. Participants with more broad commodities and derivatives backgrounds expressed this generally, but nine participants with experience in waste and recycling had more specific insights. "Recyclables" are not a single category of material; there are dozens of material types collected from homes and businesses, including multiple categories of paper, fiber, plastic, and glass.

While previous research detailed price volatility for different materials, interview participants provided valuable context and caveats. For instance, the former CEO of a major paper fiber recycler and packaging manufacturer noted that a futures exchange for pulp and paper, while theoretically valuable, would likely not be used by major industry participants. Most pulp and paper collected for recycling in the United States comes from commercial establishments like retailers, who frequently have price, volume, and logistics agreements with paper mills and packaging manufacturers. While smaller pulp and paper processors might benefit from the risk management attributes of futures contracts, this interview participant believed there would not be enough trading activity to make recycled pulp and paper contracts viable.

However, interview participants with experience in waste and recycling were sanguine regarding the potential for contracts on major grades of recycled plastics. Buy-side firms looking to guarantee supply of a particular grade or variety of plastic could purchase futures contracts, encouraging sell-side firms and processors to more aggressively process plastic grades covered in the futures contract and keep those plastics from the landfill. This attribute of recycled materials futures trading was highlighted by two interview participants: the CEO of a major regional U.S. recycling processing center and an executive at a plastics industry advocacy group. Both participants observed that the supply of recycled material is relatively inelastic—haulers have contractual obligations to collect material from homes and businesses regardless of whether there is a functional market for that material. Greater transparency and price certainty allow buy-side brands to better meet commitments to sell products with recycled content, while sell-side firms could focus on materials with demonstrable demand, making recycling collection and processing efforts more valuable and effective.

3. Mode of Settlement: Cash versus Physical

The question of how to settle transactions on a derivatives exchange is vitally important, and all five interview participants with backgrounds in commodities and derivatives markets mentioned this issue. However, only one interview participant from the waste and recycling industry mentioned the issue of settlement, suggesting less familiarity and sophistication regarding derivatives among recycling industry participants. It is unsurprising that members of the recycling industry have less experience with derivatives since there is no current recycled materials futures market; the largest potential user group for these futures would be encountering the technology and market mechanism for the first time.

Some derivatives trade with physical settlement, meaning the "underlying" commodity changes hands on a predetermined date for a previously agreed-upon price. Other derivatives trade with cash settlement, meaning that buyers and sellers exchange the cash difference between their agreed price and an established "index price" on a predetermined date. It was initially assumed that cash settlement would be better for recycled materials futures contracts given the potential logistics complexities. However, cash settlement requires the creation of a credible, regulator-approved index demonstrably free from market manipulation—a tall order in the opaque recycled materials OTC trading marketplace. Conversely, while logistics of physical settlement (physical space needs and a system for warehousing, inspecting, and tracking material) are considerable, regulatory approval from the Commodity Futures Trading Commission (CFTC) for physically settled contracts is eminently possible and clearly outlined.

Futures contracts with cash settlement expire to the price of some transparent, robust index widely accepted by both market participants and financial regulators such as the CFTC. On the expiration date, buyers and sellers settle funds based on the index closing price. Suppose two parties exchange a cash-settled futures contract for 250 shares of the S&P 500 index at $2,000/share. On the expiration date, the S&P 500 index closes at $2,100/share. The buyer receives $25,000 [1 contract × 250 shares/contract × ($2,100 closing price/share − $2,000 futures price/share)] from the seller. The parties do not actually exchange the shares of stock that comprise the S&P 500 index. The main value of a cash-settled approach is utilizing market mechanisms to establish a price, hedge risk, and determine supply and demand.

All futures contracts initially traded on the Chicago Board of Trade in 1948 were physically settled. The eventual physical delivery at maturity promotes convergence between prices in the futures market and spot market through market participants seeking arbitrage opportunities. Logistics of physical delivery are specified in contract settlement terms: specifications on asset quality, acceptable delivery locations, responsibility for transportation and storage costs, and so on. These rules protect participants from undesirable surprises upon delivery, like picking up from some remote location, or paying exorbitant shipping fees. Physically settled contracts typically specify a list of warehouses capable of storing the commodity, and "taking delivery" involves transferring a warehouse receipt or shipping certificate. Upon taking possession of title to the goods, one may continue keeping them in the warehouse, pay the requisite storage costs, and, assuming the commodity is non-perishable, reuse it as collateral for new futures contracts. A warehouse system also helps eliminate potential problems or fraud, promotes physical security of the goods, and facilitates conducting independent inspections for material quality and quantity.

Before the contract expires, participants can trade out of their positions without waiting for expiration and delivery. For example, the buyer of one futures contract for some underlying asset for $1,000 may sell the contract once futures price changes to $1,100 and earn $100 profit without taking physical delivery. In modern futures markets, only about 1% to 10% of all contracts traded are held until delivery. In terms of regulatory compliance, it may be easier to list physically settled contracts, if the exchange can provide independent warehousing and inspections for specified quality standards. It is harder to convince the CFTC that the underlying price index is robust and not easily manipulated. The existence of physical collateral and the "threat" of physical delivery naturally limits the risks present in cash-settled contracts.

The mode of settlement, though seemingly insignificant, is critical. Mode of settlement, according to 4 of 13 participants, could encourage or discourage the participation of various "market making" entities (e.g., clearinghouses, commodities traders, speculators) who frequently provide important trading liquidity to commodities markets. Thinly traded commodities are more susceptible to price volatility, one of the main issues that recycled materials derivatives are intended to address. The companion to this case study (Moore & Howell, in press) examines avenues for both cash and physical settlement on PCM futures, and in particular, how to determine an acceptable index for a cash-settled contract and the specific infrastructure and logistical requirements for a physically settled contract.

4. Role of State and Federal Policy

Five out of 13 interview participants mentioned the potential for federal and state policies to influence the uptake of an exchange for recycled materials futures. Two specific policies rose to prominence: mandatory recycled content laws and EPR laws, which would potentially have similar impacts on recycled materials markets.

Mandatory recycled content laws require some category of products (e.g., plastic drinks bottles) sold within the relevant jurisdiction to contain a minimum fraction (e.g., 50%) of recycled content. EPR laws require manufacturers or vendors of a product to make provisions for that product's end-of-life. EPR rules range from requiring manufacturers to accept products at the end of their working life to disassemble, recycle, and/or dispose of them (e.g., broken flat-panel televisions) to requiring manufacturers and/or retailers to pay per-unit fees to support municipal or other public recycling programs and facilities.

These are policy interventions with considerable potential to disrupt the status quo, for both supply and demand. However, existing market mechanisms could be unable to manage dramatic increases in market interest, and considerable market failures could result. Each of five interview participants who mentioned these types of policy interventions articulated the potential for mismatches between supply and demand to be exacerbated, especially if EPR and/or mandatory recycled content laws are not implemented uniformly. Ideally, in the United States, a federal-level rollout of these initiatives would impose uniform standards and expectations nationally. However, EPR and mandatory recycled content laws are only being considered and implemented piecemeal at the state level.

One interview participant, the founder and CEO of a major recycled materials processing firm in the United States, anticipated that the regional effects of state-by-state implementation could be particularly acute: "'neighboring states' [without EPR or mandatory content laws] recycling markets could collapse due to a flood of material." Likewise, the two environmental regulators who participated in interviews cautioned that market impacts of mandatory recycled content and EPR laws would be determined by how the rules were written. If the sell-side of recycled materials markets would expand dramatically on account of these laws, exchange-traded recycled materials contracts could provide a valuable stabilizing mechanism. Recycled materials futures contracts would better manage prices for both buyers and sellers, while also establishing that buyers for a given commodity exist and are theoretically willing to take delivery in the future, mitigating damage from any "flood" of material that might arise.

CONCLUSION

While there are undoubtedly technical and engineering challenges facing recycling collection and processing, stakeholders must also pay attention to market design and mechanics. In fact, improving PCM markets was the top priority listed in the USEPA National Recycling Strategy report (USEPA, 2021). If the impacts of introducing futures contracts for other products and markets are any guide, more efficient and effective markets for transacting PCM will lead to many positive outcomes: reducing price

volatility, raising quality standards, and improving transaction transparency. Over time, an active PCM futures market will clarify what materials are "recyclable" in practice: those with liquid markets where contracts actually trade. If contracts for a certain type of material are not actually trading, then that reflects limited demand for that type of material. Municipalities could use this market data to determine the specific assortment of materials to collect, more confident in a market for their sale and subsequent reuse. Similarly, haulers and processors could justify the exclusion of certain grades of material from the waste stream. Regulators and environmentalists would take note and remove illiquid materials from lists of recyclable materials. Ultimately, packaging manufacturers might focus attention on PCM products with stronger secondary markets, rewarding firms for using materials that are actively traded and discouraging use of materials with no real secondary market. Certain materials might come back into fashion for packaging purposes while others would fade out, with net economic and environmental benefits for broader society.

The potential for a futures market to transform the recycling industry lies in its ability to address both economic and environmental challenges. By providing price stability and enhancing market transparency, futures contracts could mitigate key barriers that have long hindered the growth of recycled materials markets, including price volatility, inconsistent quality, and supply chain inefficiencies. Beyond stabilizing the market, such a mechanism could foster trust and standardization, paving the way for recycled materials to compete more effectively with virgin resources. These improvements align closely with broader sustainability objectives, such as reducing waste, conserving natural resources, and supporting circular economy principles.

However, realizing this vision requires addressing significant challenges. The diverse range of materials in the recycling stream, combined with existing inefficiencies in OTC trading and regulatory uncertainties, necessitates careful design of both the contracts and the market infrastructure. Interview participants highlighted the importance of selecting the right commodities, enforcing quality standards, and determining an appropriate mode of settlement—issues that will determine the market's feasibility and success. Additionally, state and federal policies, such as mandatory recycled content and EPR laws, could either bolster or destabilize market dynamics, depending on their implementation.

Ultimately, this case study demonstrates that a futures market for recycled materials has the potential to drive meaningful change in the recycling industry, but its success will depend on thoughtful collaboration among stakeholders, including businesses, regulators, and policymakers. By addressing the structural barriers and leveraging the insights from this research, a well-designed market could enable businesses to manage risk more effectively, increase the adoption of recycled materials, and advance sustainability goals across industries.

CASE STUDY QUESTIONS:

1. What are the primary barriers to establishing a futures market for recycled materials, and how can they be addressed?
2. How can businesses leverage participation in such a market to enhance their sustainability profiles and manage risks?
3. What role should policymakers and regulators play in supporting the development of this market?
4. How does the proposed market align with broader sustainability goals, such as reducing reliance on virgin materials or achieving circular economy objectives?
5. How can the success of a recycled materials futures market be measured, and what metrics would be most effective in evaluating its environmental and financial impacts?

AUTHOR CONTRIBUTIONS

Jordan P. Howell: Conceptualization, methodology, data collection, formal analysis, writing—original draft, writing—review and editing, visualization, project administration, funding acquisition.

Jordan S. Moore: Conceptualization, data collection, writing—review and editing, funding acquisition.

COMPETING INTERESTS

None.

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SUPPLEMENTAL MATERIAL

Teaching Notes.docx

APPENDIX 1

Interview questions

1. Can you tell me about your roles in solid waste management/derivatives/environmental regulation over the course of your career?
2. From your perspective, what have been the most significant challenges facing the market for recyclable materials over the course of your career?
3. Do you think a derivatives exchange for recycled commodities could benefit the industry? Why or why not?
4. What are the benefits and drawbacks of a derivatives exchange for recyclables?
5. How has the legislative and regulatory environment for waste management changed over time, and how would a derivatives exchange fit into this evolution?

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