Remanufacturing Office Furniture through 'Workspace as a Service' Models: A Pathway to Economic, Environmental, and Social Circularity

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Abstract

The global demand for sustainability is reshaping the corporate world, pushing companies to rethink traditional models of asset management and consumption. One area of significant concern is the waste generated by office furniture. According to the US EPA, an estimated 9.7 million tons of furniture end up in landfills every year and office furniture is the major component of this material. The office furniture industry encompasses a $15 billion US market with 5% annual growth expected through 2030, and these assets have great material and economic value even at the end of their first useful life. Currently, standard industry practice is to dispose of office furniture when businesses close, downsize, or remodel. Since there are few viable avenues for this bulky, mixed material stream, the furniture primarily goes to waste streams.

To counter this trend is a novel approach to office furniture remanufacturing and ownership such that the material stays within a circular economy. For over four decades, Davies Office (Davies) has remanufactured office furniture and is presently implementing a novel concept of "Sustainable Banking," whereby companies can "bank" their legacy furniture assets for future remanufacture. By developing a WSAAS model rooted on the foundation of “Sustainable Banking”, we can generate economic opportunities for marginalized communities. This approach focuses on partnering with women-owned and disadvantaged community-owned businesses to divert materials from landfills. Additionally, we see an opportunity to leverage technology to enhance this practice while expanding the remanufacturing supply chain within the office furniture industry. This paper explores an opportunity to innovate in the current business model through implementation of WorkSpace as a Service model.

Currently, the effort to acquire, store, and maintain inventory of remanufactured furniture is a significant undertaking from a centralized location. “WorkSpace as a Service (WSaaS)” could be coupled with an expanded supply chain that integrates disadvantaged communities in a hub-and-spoke franchise model. The hubs in this model are the remanufacturing centers, while the spoke are the sales, distribution, installation, and reuse centers. To realize this expansion, several actions must be taken. First, the business model must be refined and adopted by partners across the U.S. to avoid the environmental impact of shipping the heavy furniture long distances back to Davies. The adoption of new inventory and resource management software that fits the unique needs of the remanufactured furniture market. Available ERP tools must be customized with an AI image module to support the logistical aspects of the proposed supply chain model. A more intelligent software platform will enable remanufacturers to accurately identify parts and correctly link them to inventory for future orders; it takes over one year to train employees to do this today.

Introduction

In response to the evolving workforce dynamics—shaped by remote, hybrid, and collaborative work arrangements, companies must evaluate the optimal use of physical office space. This has far-reaching implications for achieving sustainability targets, such as net-zero emissions, meeting Science-Based Targets, and contributing to UN Sustainable Development Goals. The WSaaS model provides businesses with the flexibility to deploy remanufactured office furniture on-demand, which aligns with their sustainability and green building goals, including LEED certification. There are a growing number of business models in which a third party delivers a service to businesses where the asset is owned by the service provider; this is defined as "WorkSpace as a Service" (WaaS). An example practitioner of this model is Xerox, who deployed remanufactured copiers and delivered "copy as a service," while retaining ownership and extracting value by extending the remaining life their asset (i.e. copier). The vision for this WaaS model, where the supply chain hubs and spokes own the assets (i.e. office furniture) and customers are charged a periodic fee per workspace deployed. This allows companies to avoid making a net Furniture, Fixtures, and Equipment (FF&E) purchase for a new or remanufactured asset, because they instead use WSaaS.

In 2016, Rochester Institute of Technologie (RIT) performed an ISO 14044 compliant comparative LCA comparing the Davies remanufactured workspaces to OEM workspaces, where a reduction in equivalent greenhouse gas (GHG) emissions was shown (kg CO2eq). The Davies system GHG emissions were 17% of that released in fabrication of new OEM office furniture. The production of steel was found to be a significant contributor of the environmental impacts of the OEM office system. Davies' nearly complete reuse of the steel found in the office furniture products virtually eliminates those impacts. OEM office systems have improved their environmental footprint through the use of more recycled steel than in 2016; however, the remanufactured product still generates only 27% of the GHG emissions as those released in fabrication of new OEM office furniture.

Based on interviews with furniture remanufacturers and subsequent model calculations, a hub and spoke model in conjunction with WSaaS, we expect the beneficial impact of shifting from today's value of 1% remanufactured office furniture in the market to our goal of 10% is 2,206,000 Metric Tons of CO_{2eq} avoidance and 1,587,000 Metric Tons of material diverted from landfill over a decade, while growing 8,140 jobs and $16B within the same time period. These metrics can be achieved if the innovative WSAAS / hub and spoke model reaches fruition, where a viable supply chain is created incorporating disadvantaged communities across the US.

This WSaaS model minimizes the flow of material to municipal solid waste, MSW, because the furniture cores (used goods returned for remanufacturing) have significant value for remanufacturing and the owner is incentivized to keep the material. Additionally, the flexibility of WSaaS allows company expenses to be coterminous with building lease terms and adjust to employee fluctuations. Lastly, remanufactured furniture is 43% less expensive on average than new OEM furniture and can also contribute to a company's climate and sustainability goals (e.g., LEED).

The requirements associated with this solution are as follows: a) adoption of WSaaS by customers, b) setup a logistical network across the U.S. to effectively reduce emissions, and c) implement software solutions to appropriately manage the furniture cores and optimize remanufactured inventory. WSaaS represents to the client procuring the furniture an initial cost savings, cost avoidance at end-of-life, and emissions avoidance with remanufactured furniture. A future Life Cycle Assessment (LCA) by RIT will fully assess the impact of the new supply chain model. A hub-and-spoke setup, where disadvantaged community owned businesses will be the spokes (sales, marketing, distribution, and reuse centers) and Davies will be the first hub (remanufacturer). Ultimately, the concept will be extended to multiple hubs. Last, the development of a customized Enterprise Resource Planning (ERP) solution will enable efficient tracking of cores and balancing inventory to customer demand, while also aiding in logistical decisions.

This paper explores the remanufacturing of office furniture as a sustainable solution, particularly through a "WorkSpace as a Service" (WSaaS) model, which offers both economic and environmental benefits. By adopting this model, businesses can transition away from purchasing office furniture to a flexible service-based arrangement that supports sustainability while retaining valuable capital.

Technology

Currently, the industry uses antiquated software and extensive human tracking to remanufacture furniture, because trials of newer software tools failed to meet the sales, sorting, inventory/ warehousing, and resource planning needs. Modern ERP systems are more configurable and use embedded Artificial Intelligence (AI) algorithms to optimize supply chain processes and production[1]. That said, the AI modules in modern ERP systems are primarily focused on data analytics, optimizing workflows, and enhancing forecasting accuracy, which is helpful but misses key needs of the furniture remanufacturing industry. Specifically, a preferred ERP system for furniture remanufacturing will have the capability to recognize cores (returned products for remanufacturing) to enable accurate inventory and warehousing practices that streamline the fulfillment of work orders.

The nuances of office workspaces require well-trained individuals (1-year learning curve) to effectively decommission, sort separated, disorganized incoming materials by make, model, color, and part number (e.g., Steelcase brand plastic corner cap vs Herman Miller end cover), which is not tenable in today's evolving workforce. An ERP system with custom AI image-based identification can overcome these challenges as evident in the work performed by RIT on AI for core identification. To this end, RIT developed requirements for ERP software that identify remanufacturing cores through AI based image classification algorithms. Successful implementation of the algorithms by an ERP vendor provided proof-of-concept credibility by automatically identifying the furniture make/model and defining the proper inventory connection. By addressing these challenges, WSaaS adoption of technology, partnerships, and sustainable practices that are economical and environmentally sound.

The "Sustainable Banking" Foundation

The paper introduces a novel existing business model of "Sustainable Banking," whereby companies "bank" their furniture assets for future remanufacture. By carefully deinstalling and transporting used furniture with minimal damage, these "cores" can be reconditioned and redeployed to meet new workspace requirements. This process extends the life cycle of furniture and minimizes waste, significantly reducing embodied carbon, energy consumption, and toxic material use.

Conclusion

Through this paper, we highlight how the WSaaS model can support both economic growth and environmental sustainability. We will also present findings from lifecycle analyses (LCA) that demonstrate the benefits of remanufacturing over multiple life cycles and its impact on reducing material waste and energy consumption. The WSaaS model, through its circularity-driven approach, offers a path toward meeting broader ESG goals while fostering resilience and sustainability in the corporate workspace. The data tells a compelling story. According to Gallup research, 70% of workers value flexibility in how and where they work. Companies that embrace adaptable workspaces see 25% higher employee satisfaction and a 20% boost in productivity. WaaS capitalizes on this momentum, aligning environments with evolving needs to drive engagement and performance.

The WSaaS model presents a compelling solution for businesses seeking to achieve their sustainability goals while maintaining a functional and adaptable workspace. By embracing remanufactured furniture and a service-based model, companies can reduce their environmental footprint, support economic development in underserved communities, and contribute to a more circular economy.

Further Research

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[1] https://www.top10erp.org/blog/ai-in-erp

This paper lays the groundwork for further research into the economic and environmental benefits of WSaaS on a larger scale. Future studies could explore the integration of WSaaS with enhanced ERP software solution and with building information modeling (BIM) for optimized furniture deployment and life cycle management. Additionally, research into the social impact of WSaaS, particularly its potential for job creation and community development, would be valuable. We encourage businesses, policymakers, and stakeholders to embrace the WSaaS model as a key strategy for achieving a more sustainable and circular future for the office furniture industry. By working together, we can create a more responsible and resource-efficient WorkSpace environment

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Mark is the founder of One Boat Collaborative and Ex VP of Sustainability for Staples INC. He's an experienced sustainability professional who drives organizational change by integrating circular economy principles. Focuses on materiality, measurable goals, and stakeholder engagement. Expertise spans operational sustainability, supply chain, and collaborative solutions, delivering real business value while minimizing environmental and social impacts.

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Doug Pilgrim is a seasoned environmental professional in the contract furniture industry with over 30 years of experience. He possesses LEED AP® ID+C and WELL AP credentials, demonstrating expertise in green building and occupant well-being. A recipient of the Interface Everest Award, he actively contributes to the ANSI/BIFMA e3 sustainability standard and holds an economics degree from the University of Massachusetts.