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SUSTAINABILITY IN THE MATTRESS INDUSTRY

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1. INTRODUCTION

Sustainability has become an expected part of how companies talk about themselves and how consumers think about products. Food, fashion, packaging, and logistics are already under constant pressure to reduce waste, lower emissions and use resources more responsibly. The mattress industry, however, is rarely part of this conversation, even though it clearly should be. Mattresses are large, long-lasting, and made from multiple materials such as steel, polyurethane foam, textiles and adhesives. They are difficult to collect, transport and dismantle, and in many cases, they end up in landfills, incineration, or simply dumped in public spaces. At the same time, a significant share of these materials could be recovered and reintroduced into production if proper systems were in place. In recent years, technological developments, pilot recycling schemes, and new policy initiatives, especially in Europe, have started to target this problem and push the sector toward more circular models. What is much less clear is how this emerging "sustainable mattress" narrative looks in practice, and how it is perceived outside of policy papers and corporate marketing. While some companies promote eco-friendly or recyclable mattresses, it is uncertain how well consumers understand these claims, whether they see mattress recycling as realistic, and under what conditions they would choose a more sustainable option or return their old mattress instead of discarding it as bulky waste. This thesis focuses on that gap. It examines how sustainability and circularity appear in the mattress industry and how potential consumers relate to eco-friendly mattresses and mattress recycling, not just in theory. By combining insights from existing literature, an expert interview and an online questionnaire, the research aims to highlight where expectations, practical options and consumer behaviour do not yet match, and what would need to change for sustainable choices in the mattress sector to become more visible, accessible and workable in everyday life.

1.1 Research questions

1. How is sustainability, and specifically mattress recycling, currently addressed in the mattress industry at an international and European level?
2. How familiar are consumers with eco-friendly / sustainable mattresses and mattress recycling?
3. Which factors influence consumers' mattress purchase decisions, and how does sustainability compare to comfort, durability, price, brand and other criteria?

4. To what extent are consumers willing to choose an eco-friendly mattress if it is more expensive (e.g. 10–20% price premium), and under what conditions would they participate in mattress recycling programmes?
5. What practical barriers and motivating factors do consumers identify regarding mattress recycling and sustainable mattress choices?

2. LITERATURE REVIEW

2.1 Background and importance of sustainability

Sustainability has become a central focus in modern manufacturing and consumer markets. Driven by growing environmental awareness and evolving regulatory frameworks. While extensive research has been conducted in industries such as food, fashion, and transportations, the mattress industry remains comparatively underexplored in both academic and industry literature. This gap is notable because mattresses are complex, multi material products produced in high volumes, generating significant flows of foam, textiles, metals, and glues across their life cycle. As a result, choices about design, sourcing, and end-of-life management can have meaningful environmental and economic consequences, yet they are less frequently analysed than in other sectors. The topic is also timely: circular economy policies and producer responsibility schemes are expanding, and companies are beginning to invest in recycling and traceability that directly affect mattress production and disposal. To place the current discussion in context, it is therefore important to look back at how the idea of sustainability developed over time, since today's industry practices are rooted in concepts that emerged long before the term became mainstream.

2.2 Historical roots of sustainability concepts

The emergence of sustainability as a mainstream concept during the 1980s can be better understood by tracing its earlier intellectual and practical roots. Many of these foundations were established long before the term "sustainability" entered common usage. Scholars such as Grober, Caradonna, and Du Pisani point to contributions from diverse historical contexts, with particular attention to forestry experts in the 17th and 18th centuries, such as Evelyn and Carlowitz, who developed the principle of sustainable yield, meaning taking from renewable resource only as much as it can naturally replace, for example cutting no more timber than grows back each year, in response to concerns over diminishing forest resources in Europe (Mulligan, 2017).

2.3 Global mattress market size and trends

Building on these conceptual foundations, industries have increasingly adopted sustainability frameworks to guide both production and end-of-life management of goods. In the mattress sector, it is important to note the scale of the industry before discussing sustainability challenges. (Taveggia, 2025) explains that the global mattress market has worth around 31 billion USD in 2024, making is a substantial component of the furniture sector. Consumption is heavily concentrated in a few large markets, with the United States, China, India, the United Kingdom, and Brazil together accounting for most of the global demand. Asia-Pacific is the leading region, followed by North America, while Europe representing about one-fifth of global consumption. International trade has also become increasingly significant, reaching 5.5 billion USD in 2024, which is approximately 17% of total consumption compared to only 12% in 2015. However, trade pulls, particularly U.S. anti-dumping measures, have reshaped global flows by reducing export from countries like China and encouraging suppliers from Turkey, Serbia, and Asian nations to redirect their products toward Europe.

2.4 Recycling and circular economy in the mattress industry

2.4.1 Mattress Recycling Council (MRC) programmes

Recycling has since emerged as a practical application of circular economy principles within the mattress sector. According to the Mattress Recycling Council (2024), nearly 1.5 million mattresses were collected for recycling in 2023, marking a 3.3% increase compared to the previous year. These efforts demonstrate how sustainability transitions can be operationalised by reducing landfill waste, recovering valuable materials such as polyurethane foams and metals, and reintegrating them into new production processes. Such programs not only reduce environmental pressure but also contribute to social and economic sustainability by creating jobs, lowering disposal costs, and aligning with regulatory frameworks. In this sense, mattress recycling illustrates how the three pillars model can be applied in practice, linking environmental protection with economic viability and social benefit (Adusei, 2024).

2.4.2 Quantitative achievements and environmental impact

The effectiveness of these initiatives can be seen in the specific outcomes achieved by MRC programs. In 2023 alone, recycling efforts diverted more than 60 million pounds of steel, foam, fibre, and wood from landfills, reaching a recovery rate nearly 77% (Mattress Recycling Council | Recycling Programs in California, Connecticut & Rhode Island, n.d.). Accessibility has also been a focus: in California, nearly all residents live within 15 miles of one of 240 permanent collection sites or 131 collection events, ensuring widespread participation. Beyond reducing landfill waste, the MRC has also tackled the problem of illegal dumping, removing 55,00 abandoned mattresses from streets and public spaces in 2023 (Mattress Recycling Council | Recycling Programs in California, Connecticut & Rhode Island, n.d.).

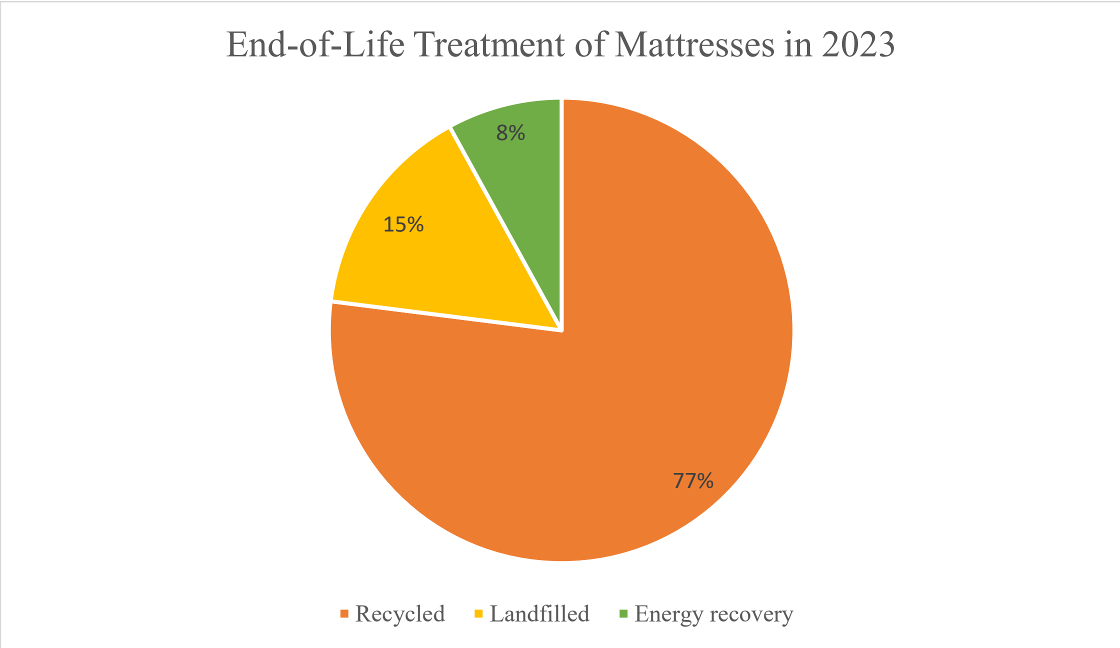

Figure 1: Share of recycled, landfilled and energy-recovered mattresses (Mattress Recycling Council, 2024).

2.4.3 Social and economic benefits

State level programs highlight further progress. In Rhode Island, nearly 80,000 mattresses were recycled in 2022-2023, reclaiming over 1,500 tons of material (Mattress Recycling Council Rhode Island, LLC, 2023). In Connecticut, the MRC collected 195,725 mattresses and foundations, recovering 3,456 tons of material and saving municipalities an estimated 3.25 million USD annually in disposal costs (Wall, 2024). These figures illustrate how mattress recycling delivers not only environmental benefits, but also measurable economic value for local governments and communities. Together, these results demonstrate that sustainability is not limited to abstract frameworks but can be achieved through concrete industry practices. At the same time, they underline the need for continued innovation and consumer engagement to further expand participation and ensure long-term effectiveness.

Beyond these quantitative achievements, MRC programs also generate broader environmental benefits. A life cycle assessment conducted in California found that recycling 1.6 million mattresses in 2021 prevented approximately 39,000 metric tons of CO2-equivalent emissions, comparable to avoiding the combustion of 3.8 million gallons of diesel fuel, while preserving around 900 million gallons of water and reducing energy demand by 710 terajoules terajoules (Life Cycle Analysis of Mattress Recycling in California, n.d.). These results highlight the significant role mattress recycling can play in progressing climate goals and resource conservation strategies. Operational improvements have also been pursued to increase efficiency. For example, an experimental program testing a specially designed trailer that compresses collected mattresses by at least 50% demonstrated a 26% reduction in transportations costs, illustrating how logistical innovation can both reduce environmental impacts and enhance the economic feasibility of recycling (Compression Trailer Summary Report, 2024).

Building on the environmental results and logistical efficiencies the MRC has also funded research to expand the range of applications for recycled materials. One recent initiative developed a process to convert polyurethane foam into mouldable elastomers, which can then be repurposed for manufacturing products such as shoe soles, mats, and dock bumpers. These advancements illustrate how mattress recycling can move beyond waste diversion to actively create value-added products, supporting the transition toward a circular economy (Serajian and Serajian, n.d.). Taken together with the programme outcomes already noted, these results demonstrate that mattress recycling not only aligns with the principles of environmental, social, and economic sustainability, but also shows how industries can integrate circular economy practices into existing systems. At the same time, challenges remain in ensuring stable end markets for recycled materials and maintaining high levels of consumer participation, indicating a continued need for research, innovation, and supportive policy frameworks.

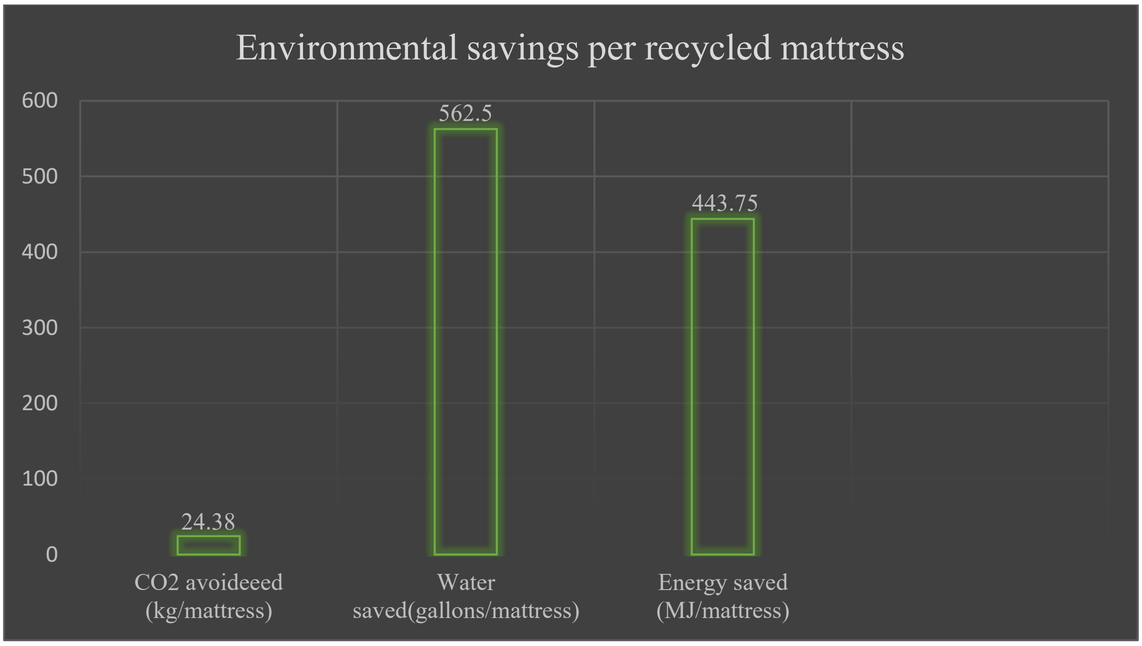

Figure 2: Per-mattress environmental savings from mattress recycling (Life Cycle Analysis of Mattress Recycling in California, n.d.).

2.5 Material-Specific Challenges – Polyurethane (PU) Foam

2.5.1 Properties and applications of PU foam

Turning from applications to material-specific challenges, polyurethane (PU) foam is one of the most significant materials in the mattress recycling stream, both in terms of quantity and in terms of the challenges it poses for achieving circularity. PU foam is a lightweight, cellular material, typically with an open cell network, engineered to deform and recover in a controlled, viscoelastic way. In mattress-grade flexible foams, comfort is driven by morphology: cell size, density, and connectivity shape surface feel, resilience, hysteresis and resistance to "bottoming out", that is essentially when foam compresses so much that you feel the hard surface underneath instead of the foam. Put simply, PU foam is practical cushioning that is light, springy and durable, which is why it dominates bedding and seating requirements. (Scarfato et al., 2017).

2.5.2 Types of PU foams

Within this category, several distinct types are produced to meet different performance needs. Conventional flexible foams, most often based on toluene diisocyanate (TDI), provide a balanced combination of support, resilience and breathability, while high resilience (HR) foams, typically made with methylene diphenyl diisocyanate (MDI), have a more open cell structure and greater elastic recovery, enhancing durability and load-bearing capacity (Wirawan et al., n.d.; Gama et al., 2018). Viscoelastic or memory foams, in contrast, are formulated to exhibit slow recovery and temperature dependant softness, a property achieved through specific additives and crosslinking (Wirawan et al., n.d.; Sonnenschein et al., 2017). Other). Other specialised variants, such as gel infused or combustion-modified foams, target thermal regulation or improved fire performance (Gama et al., 2018). In 2022, MRC programs in California alone recovered virtually 12 million pounds of flexible PU foam, underscoring its central role in recycling operations (Wirawan et al., n.d.).

2.5.3 Recycling difficulties and market barriers

Unlike metals or wood, which have long established secondary markets, foam is more problematic to recycle because of its diverse chemical compositions and limited downstream uses. Traditionally, most recovered PU foam has been processed into carpet underlay, but demand for this product has steadily declined, leaving recyclers with shrinking market options. Furthermore, foams used in mattresses differ widely in terms of polymer backbones, crosslinking density, and formulation, leading to considerable issues, reducing product quality and limiting economic value. To address these challenges, the Mattress Recycling Council has invested in research aimed at developing scalable methods for foam classification and reuse. A recent UCLA-led study analysed over 110 samples of post-consumer foam and introduced the ball rebound, or “rebound resilience”, test as a low-cost, effective method for distinguishing between foam types. The results demonstrated that viscoelastic (memory) foams consistently exhibited rebound values below 15%, while conventional foams typically measured above 27%. These mechanical differences correlated strongly with underlaying chemical and structural features, including whether foams were MDI or TDI-based and the extant of crosslinking (Wirawan et al., n.d.). By enabling recyclers to sort foams more accurately, this method reduces contamination, improves the efficiency of downstream processes, and expands the potential for higher value applications. Conventional foams, for instance, may still be directed to mechanical recycling pathways, while viscoelastic foams could be routed to advanced chemical recycling or thermal conversion.

2.6 Recycling technologies

2.6.1 Mechanical recycling (AIR-LAY)

Within material-focused framework, mechanical processing technologies such as the AIR-LAY system have ben developed to further improve foam recovery. AIR-LAY is a process that converts flexible PU foam into a nonwoven material by mechanically shredding and bonding fibres without the use of adhesives or binders. This technique allows large volumes of post-consumer foam to be processed into lightweight, resilient mats with diverse industrial applications, ranging from insulation and soundproofing to padding and protective packaging (Liberati et al., 2024). Compared to conventional shredding methods, AIR-LAY achieves higher product uniformity and durability, making it a promising solution for advancing mattress foam recycling. Importantly, it also addresses the issue of limited end markets by generating a versatile material that can be tailored to different performance needs.

2.6.2 Thermochemical recycling (pyrolysis)

Beyond mechanical recovery methods such as the AIR-LAY process, alternative technologies are being developed to handle the complex composition of old mattresses. One such approach is pressurised pyrolysis, which can reduce the amount of waste going to landfill while also creating useful outputs. Pyrolysis heats shredded mattress materials to high temperatures without oxygen, breaking down foams and textiles into smaller chemical compounds. Serrano et al. (2024) tested this process under different temperatures and pressures and found that it produces three main products: a combustible gas, a liquid with hydrocarbons and nitrogen compounds, and a solid char that is rich in carbon. The results showed that the operating conditions strongly affect how much energy can be recovered, with lower pressures giving better energy efficiency. The char had a high energy value, which makes it suitable as a substitute fuel, while the liquid fraction could also be used for industrial applications (Serrano et al., 2024). From a sustainability point of view, pyrolysis complements mechanical recycling by dealing with mixed materials that are harder to reuse directly, offering another route for mattress waste to fit into circular-economy strategies instead of ending up in landfill.

2.6.3 Alternative reuse pathways (construction insulation)

As a complementary reuse pathway to the AIR-LAY and pyrolysis routes, Thompson et al. (2025) explored whether materials from end-of-life mattresses could be repurposed into insulation board for construction. They collected discarded polyurethane foam and textile layers from mattresses and shredded them into smaller pieces, then mixed these shredded materials with different types of binders and pressed them into rigid panels. The researchers tested the panels for thermal conductivity, acoustic insulation, and mechanical strength to compare performance with conventional insulation products. Their results showed that the board offered insulation performance like commercial materials, while mechanical tests demonstrated that the panels were strong enough for practical use in building applications. The study also highlighted that the choice of binder and specific processing conditions, such as temperature and pressure during pressing, influenced the durability, rigidity, and overall quality of the panels. In addition, the research examined the composition of the mattress waste to understand how different foam types and textile layers affected the properties of the final product. Thompson et al. (2025) observed that even with variability in the waste inputs, the process could consistently produce panels that met standard building material requirements. Using mattress waste in this way also reduces the volume of material sent to landfills and replace conventional insulation products that are more energy intensive to manufacture, such as mineral wool or expanded polystyrene, showing that discarded mattresses can become a functional raw material for other industries.

2.7 European context

2.7.1 Material flows and recycling rates in the EU

Expanding from reuse pathways to the system-wide material picture in Europe. Like in other parts of the world PU foam is one of the key materials used in mattress and furniture industries, with almost 90% of mattresses manufactured in the European Union containing between 2 and 30 kilograms of this material, and virtually all padded furniture also relying on it (EUROPUR, 2021). In 2020, Europe had around 109 slab stock foam plants, together producing about 1.1 million tonnes of foam, of which roughly 35% went into mattresses and 50% into furniture, illustrating the scale of this material flow within consumer product. Foam production itself generates significant volumes of off-cuts, often referred to as trim foam, which can reach up to 24% of output. In 2018 global trim foam amounted to almost 1.2 million tonnes, with Europe contributing approximately 316,000 tonnes. While these off-cuts are commonly valorised in secondary markets such as a bonded foam for carpet underlay or fillings for cushioning and pillows, the challenge grows much greater when foam reaches the end of its life within a finished product. Each year, around 40 million mattresses are discarded in the EU, a dramatic increase from the 30 million reported in 2012. This figure translates into a theoretical end-of-life foam volume of 250-300 thousand tonnes for mattresses and 350-400 thousand tonnes for furniture, though actual recycling rates depend on the ability to collect these bulky items separately from other waste streams, something that is still very limited across Europe (EUROPUR, 2021).

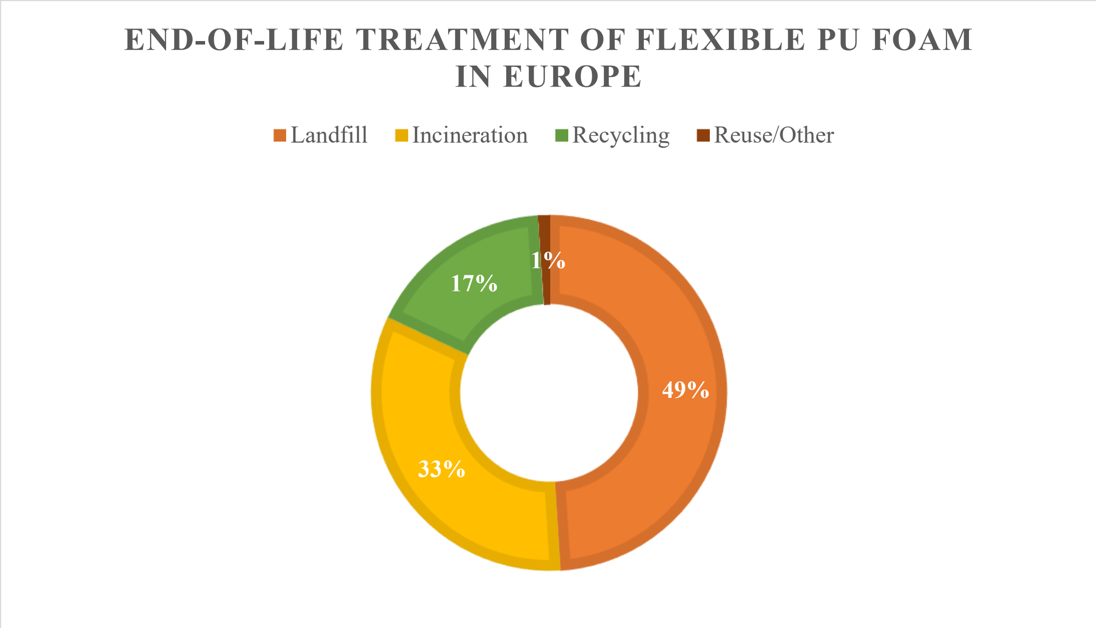

Figure 3: End-of-life pathways for PU foam from mattress and furniture in Europe (EUROPUR, 2021).

2.7.2 Policy drivers

The current situation shows that about 49% of mattresses are still landfilled, 33% are incinerated for energy, and only 17% are recycled, while the figures for furniture are even worse, with less than 10% being recycled overall. This outcome conflicts with European environmental policy, since the revised Landfill Directive requires member states to reduce municipal landfill rates to a maximum of 10% by 2035, while the Waste Framework Directive has introduced key concept such as “end-of-waste”, which could allow polyurethane to be reclassified as a secondary raw material instead of simple waste if effective recycling systems are developed EUROPUR, 2021). Recycling technologies have indeed been evolving, and the EUROPUR report categorises them broadly into mechanical, chemical, thermochemical and, as a last resort, energy recovery processes. Mechanical recycling, currently the most established pathway, shreds and reprocesses foam into bonded applications such as rebond underlay, but this route depends heavily on demand in those secondary markets and faces limitations due to potential contamination by legacy chemicals. More promising long-term solutions are emerging in chemical recycling, which breaks PU down to its molecular components, allowing polyols to be recovered and reused in new foam production. Several industrial initiatives have already been launched, including Repsol’s plat in Puertollano in Spain, Covestro’s chemolysis process in Germany, BASF's pilot tests in Schwarz Heide, and Triple Helix's split-phase glycolysis technology in Belgium, all of which aim to recover polyols and, in some cases, diisocyanate precursors from post-consumer mattresses. Thermochemical methods are also being explored, using heat to decompose polyurethane into feedstock close to virgin raw materials. However, all these approaches still face significant barriers. Effective chemical recycling requires clean and homogeneous feedstock, which is difficult to secure without efficient collection and sorting systems, and bulky waste logistics remain underdeveloped in many EU member countries. Even mechanical recycling, though technically proven, is constrained by limited end-markets for bonded foam products. As a result, despite policy pressures and technological progress, the reality remains that much of the foam from discarded mattresses and furniture is still lost through landfill or incineration rather than being reintegrated into the circular economy (EUROPUR, 2021).

Building directly on the EU-wide material flows, barriers, and policy drivers, EUROPUR highlights the growing importance of sustainability in the flexible polyurethane (PU) foam industry through a wide range of initiatives led by its member companies, underlining how innovation is being directed toward closing material loops, reducing carbon footprints, and enhancing circularity (EUROPUR, n.d.). Nevon, for example, has committed to a comprehensive circular economy strategy, focusing on improving foam collection and reprocessing infrastructure while also working on reducing energy use in production processes (Neveon, 2023). Dow has developed novel polyurethane systems designed to integrate recycled content without compromising product performance, thereby tackling one of the core barriers to scaling mattress recycling (Dow, 2023). Evonik, in turn, is advancing chemical recycling technologies that enable the breakdown for post-consumer foam into high-quality feedstock, which can then be reused in new foam production, illustrating the industrial relevance of glycolysis and other advanced processes Evonik, 2023). Covestro has also made significant progress in chemolysis-based recycling, operating pilot projects that recover polyols from discarded mattresses and reintegrate them into new flexible foam applications, showing the feasibility of closing the loop on a larger industrial scale (Covestro, 2023). At the operational level of mattress recycling, RetourMatras in the Netherlands has developed one of the most advanced dismantling and material recovery facilities in Europe, demonstrating that large-scale separation of foam and other mattress components can provide a reliable supply of feedstock for recycling technologies is supported by efficient collection and policy frameworks (RetourMatras, 2023). Meanwhile, Economic Technologies has pioneered catalyst-based processes that allow carbon dioxide to be chemically incorporated into polyol production, creating a route for PU foam manufacture with lower reliance on fossil-based feedstock and reduced greenhouse gas emissions Econic Technologies, 2024). Complementing these chemical and material innovations, HS Anlagentechnik has focused on the machinery and engineering side, developing specialised systems for efficient dismantling, shredding, and pre-processing of foams, thereby strengthening the infrastructure needed to scale recycling capacity across Europe (HS Anlagentechnik, 2024). Taken together, these initiatives illustrate how industry actors are actively experimenting with and implementing diverse strategies, ranging from design and materials innovation to industrial scale recycling technologies and process optimisation, all of which align with EU regulatory goals and the broader vision of a circular economy in the mattress and furniture industry sector EUROPUR, n.d.).

2.7.3 Extended Producer Responsibility (EPR) schemes

Linking directly from the company-led initiatives and infrastructure efforts, the discarded mattress landscape across Europe is changing rapidly, driven by evolving regulatory frameworks and circular-economy goals that emphasise material recovery, especially of flexible polyurethane (PU) foam, and with approximately 40 million mattresses reaching end-of-life annually in the EU, recovering these materials has become a strategic priority (EUROPUR, 2025). The Waste Framework Directive and the Landfill Directive together aim to raise the share of municipal waste prepared for reuse or recycling to 65% by 2035, while emerging regulations such as the Ecodesign for Sustainable Products Regulation (ESPR) are expected to introduce recycled-content requirement and digital product passports to enhance recyclability and traceability europur.org. Extended Producer Responsibility (EPR) schemes have become central policy tools, shifting environmental and financial accountability upstream to producers and driving progress in collection and recycling infrastructure europur.org. In France, where around six million mattresses enter the market each year, an EPR scheme has cut the landfilling rate from nearly 100% in 2012 to under 4% today: of the four million collected annually, about 50% now undergoes recycling and 8,700 tonnes of PU foam is recovered, with the remainder incinerated due to contamination or inseparability europur.org. The Netherlands, an innovation lead in mattress recycling has achieved a collection rate of approximately 65%, with 75% of those considered suitable for recycling, the country targets a 75% recycling rate by 2028 and up to 90% of collected weight converted into useful recycles, supported in part by the automated and chemical capabilities of RetourMatras, which recycled nearly 1.5 million mattresses and saved 114 million kg of CO2-aq in 2022 europur.org. Belgium's Valumat has reached a 60% collection rate, processing about 600,000 mattresses per year (roughly 10,000 tonnes), although around 10% are lost (e.g., hoarded or exported), with dismantling capacity still scaling up europur.org. While these programmes deliver major environmental benefits, EUROPUR estimates that recycling all end-of-life mattress could avoid over 3 million tonnes of CO_2 annually, although at a cost of approximately €138 per tonne avoided (exceeding the EU ETS price of circa €65–€100), the economic and technical realities remain complex, including high transport costs, moisture and contamination issues, mixed-material complexity, and limited market uptake of PU recyclates europur.org. Despite these challenges, EPR schemes are mobilising infrastructure, levelling regulatory expectations, and supporting innovation and market formation. Nevertheless, scaling mattress recycling will require further investment in collection systems, improved product design, better sorting capacity, and sustained demand for recycled content across Europe europur.org.

2.8 Industry innovations and case studies

2.8.1 Company-led initiatives

Building on the policy architecture and EPR progress outlined above, EUROPUR's Ecodesign Considerations for Mattress Dismanteling and Recycling report (August 2024) builds on extensive interviews with 32 organisations across the mattress supply chain, including manufacturers, dismantlers, recyclers, and adhesive producers, and sets out detailed findings on how product design can support circularity in the sector (EUROPUR, 2024). Mattress producers reported that eco-design has been a growing priority for more than a decade, with some companies setting 2030 as a target date for achieving full circularity of their products. Design measures identified as essential include making covers removable and recyclable, favouriting mono-material constructions, reducing the use of hybrid innerspring or multi-layer foams, and avoiding strong glues that hinder dismantling. Alternatives such as thermally reversable adhesives or de-bondable technologies activated by heat or UV are being trialled, while some firms are even exploring no-glue designs, though these remain largely at R&D stage. Manufacturers emphasised that recyclability must be balanced with consumer comfort, as multi-layer mattresses remain popular in several markets, for example, over 90% of mattresses in Scandinavia are multi-layered, yet such complexity significantly complicates recycling. Adhesive producers confirmed that glues remain one of the most difficult obstacles for dismantling and recycling, particularly when PU is glued to latex or textiles, and highlighted efforts to introduce CR-free adhesives and bio-based formulations, as well as heat or induction sensitive bonding systems to improve separation. Mattress dismantlers reported that 43% of their incoming volumes are PU foam mattresses, 41% are innerspring, and about 8% latex, with the remainder being niche materials such as horsehair or wool, but they warned that contamination, wetness, and material diversity frequently reduce recyclability, with textiles still largely ending up as refuse derived fuel. Recovery rates for springs, PU, and latex can reach 90-95% but textiles and glued composites remain problematic. Financially, dismantlers either rely on Extended Producer Responsibility (EPR) schemes, as in France where contractors are directly paid per mattress, or charge gate fees in regions without structured support. Mechanical recyclers confirmed that PU foams can be transformed into rebond foam for uses such as acoustic insulation, gym mats, or automotive parts, but stressed that viscoelastic foams and latex contamination can cause shredding problems, while latex and acrylic based adhesives may block equipment. Chemical recyclers described active development of glycolysis, acidolysis, hydrolysis, and even hydrothermal carbonation, with current single-phase depolymerisation plants already operating in Europe and producing repolyols with a recycled content of around 38%. Split phase glycolysis shows potential to recover both polyols and aromatic amines, feeding into diisocyanate production, thereby closing the loop more fully, while hydrolysis has achieved up to 60% recycled content in foams under ideal post-industrial conditions. Challenges remain, including the need for cleaner feedstock streams, removal of flame retardants and pigments, and scaling infrastructure for collection and dismantling to feed chemical recycling plants. At present, however, even with high technical recovery rates, the actual recycled content in new mattresses is limited: if 20% of polyol is replaced by repolyol, this translates to about 5% recycled content in the foam component of a mattress. Interviewees agreed that EPR schemes, harmonised eco-design guidelines, and digital product passports will be crucial for incentivising recyclable design, ensuring consistent material quality, and enabling more advanced recycling processes to be scaled across Europe.

Continuing with the eco-design and policy insights, the information derived from this issue shows bot the resilience and adaptability of the polyurethane (PU) foam industry, with particular attention to sustainability-driven innovation (World Furniture Magazine, 2023). Flexible PU foam continues to be an essential material in mattresses and padded furniture, not only for comfort and performance but increasingly for its potential to align with circular economy objectives. European producers are described as investing heavily in reducing their environmental footprint by integrating recycled and bio-based feedstock into foam production, while simultaneously improving energy efficiency in manufacturing plants. Several companies are presented in chemical recycling processes that recover polyols from post-consumer mattresses, thereby enabling the production of new foams with measurable recycled content. These initiatives reflect a clear response to EU-level regulations such as the Waste Framework Directive and the Ecodisgn for Sustainable Products Regulation, which are pressuring the industry to adopt circular practices. The article also highlights that the foam sector is confronting challenges linked to sorting and processing post-consumer waste, particularly contamination from textiles, adhesives, and mixed-material constructions, which complicate recycling efforts. Nevertheless, ongoing R&D efforts, including the testing of novel bonding technologies and the scaling of glycolysis-based chemical recycling, demonstrate a strong industry-wide commitment to closing the loop. Overall, the foam industry is presented as a driver of innovation within the wider furniture and mattress sector, bridging material science, sustainability policy, and industrial practice, and thus serving as an important case study for understanding how circular economy principles are gradually being operationalised at scale (World Furniture Magazine, 2023).

2.8.2 Digital Product Passport and traceability

Extending this focus on industry-led innovation and alignment with EU policy, the information derived from World Furniture Magazine describes a landmark collaboration between **Avery Dennison**, **Aquinos Group,** and **TripleR,** which represents an important step toward greater mattress traceability in Europe (World Furniture Magazine, 2024). **Aquinos,** one of the continents largest mattress manufacturers with 20 factories and brands such as BEKA, Lattoflex, Swissflex, Schlaraffia, Sembella, and Superba, has committed to aligning its production with the European Unions forthcoming Digital Product Passport (DPP) requirements. From 2024, its mattresses are being equipped with digital identification technology powered by Avery Dennisons atma.io, connected product cloud, which creates a "digital twin" for each product and records detailed data on origins, materials, and composition. The tags, using both RFID and QR codes, enable recyclers to scan products during dismantling, giving them instant access to information about the polyurethane foam and other materials used, which significantly improves the precision and efficiency of separation and recovery. For consumers, QR codes provide transparency by allowing access to sustainability and material information both before and after purchase, thereby supporting more informed choices. Aquinos has set a target of tagging one million mattresses ahead of the official enforcement of the DPP, with Belgium leading implementations since its national EPR scheme, Valumat, requires RFID-enabled mattresses by 2025. TripleR and Aquinos present this initiative to bring circularity into the mainstream of bedding manufacturing, while Avery Dennison emphasises that mattresses, being bulky, multiy-material products, are especially difficult to recycle cost effectively without such a unified traceability framework. This initiative connects directly with the challenges in the foam sector, where recycling is often limited by contamination, mixed-material layers, and insufficient information about chemical additives or adhesives. By embedding digital traceability into mattress design, manufacturers can directly address these barriers, enabling recyclers to recover higher quality polyurethane foam and reducing the proportion of material lost to incineration or landfill. In practical terms, the traceability project therefore illustrates how technological innovation, regulatory alignment, and industrial collaboration can work together to support foam recycling and broader sustainability goals in the mattress industry, reinforcing the sectors commitment to operationalising circular-economy principles at scale (World Furniture Magazine, 2024).

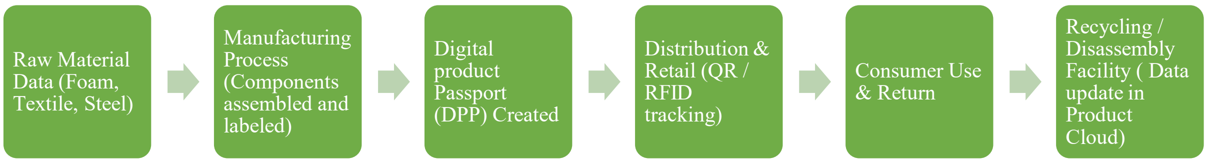

Figure 4: Digital product passport and traceability integration in mattress manufacturing (World Furniture Magazine, 2024)

2.8.3 Innovative recycling technologies

Widening the focus on traceability and EU-aligned industry action, recent developments in mattress recycling further highlight the sectors efforts to address sustainability challenges. Keane (2025) reports that the International Sleep Products Association (ISPA) and the Mattress Recycling Council (MRC) are leading initiatives to reduce landfill waste by investing in advanced recycling technologies. One such innovation is the Vitricycle process, which transforms bulky polyurethane (PU) mattress foams into recyclable thermoplastic sheets without solvents or catalysts. This method significantly reduces foam volume (by over 90%) and produces versatile resins for durable applications such as shoe soles and phone covers. Unlike traditional recycling, which mainly downcycles PU foam into low-value carpet underlayment, Vitricycle enables the production of high-performance elastomers that can compete with virgin materials (Keane, 2025). Alongside Vitricycle, MRC-funded research at Arizona State University has explored chemical modification of post-consumer PU foam to enhance its oil absorption capacity. Modified foams demonstrated up to six times higher oil to water selectivity compared to untreated foam, suggesting a promising application in environmental oil spill cleanup (Keane, 2025). These initiatives illustrate how industry collaboration and scientific innovation can transform mattress waste management from a costly burden into an opportunity for value creation and environmental responsibility, underscoring the potential of circular economy strategies in the bedding sector, particularly in addressing the pressing issue of PU foam recycling. Against this backdrop of technological progress, Tracogna (2025) points out that mattress recycling capacity in Europe is still far from sufficient to deal with the millions of units discarded every year, even though mattresses are made of materials like steel, textiles, and polyurethane foam that can often be recovered and reused. The situation is uneven across the continent: some countries such as France and the Netherlands have already introduced extended producer responsibility (EPR) schemes and developed working collection and recycling systems, while many others are only beginning to build up their infrastructure. This means that in a lot of cases mattresses still end up in landfill or incineration, which runs against the European Unions broader circular economy and Green Deal goals. To tackle this, there are investments being made in new dismantling facilities and advanced recycling methods, including chemical processes that allow polyurethane foam to be broken down and reused in higher value applications. Tracogna (2025) also highlight that expanding mattress recycling capacity is not just about sustainability, it is also creating new job opportunities across Europe, since recycling operations require workers in dismantling, transport, logistics, and plant management. This shows that mattress recycling can bring both environmental and socio-economic benefits, but it also makes clear that Europe still has a long way to go before it can match its sustainability ambitions with the actual scale of recycling capacity available.

2.9 Challenges and future directions

2.9.1 Barriers to scaling mattress recycling

While progress has been made in understanding mattress recycling technologies, circular economy strategies, and policy frameworks, sustainability in the sector remains underexplored, particularly in terms of economic feasibility, consumer behaviour, and large-scale implementation. Current research has provided valuable insights into material recovery processes such as polyurethane foam recycling, the development of new markets, and the role of state-led initiatives in advancing collection systems. However, most studies still emphasize technical and environmental aspects, leaving social and economic dimensions comparatively underdeveloped. Questions of how to secure long-term financial viability, encourage consumer participation, and integrate recycling into broader waste management infrastructures remain open and pressing. In addition, while organizations such as the Mattress Recycling Council have demonstrated that large-scale recycling is possible, challenges persist in scaling these successes beyond a few states or regions. Global supply chains, regulatory differences, and uneven levels of consumer awareness further complicate efforts to achieve a truly circular model.

2.9.2 Future research and innovation needs

Addressing these issues will require more interdisciplinary research that combines material science, industrial practice, policy analysis, and behavioural studies. Overall, the literature indicates that mattress recycling offers a promising pathway for advancing environmental, social, and economic sustainability, yet the sector is still at an early stage compared to other industries. This study seeks to contribute to filling these gaps by examining not only the technical and environmental performance of recycling, but also the economic trade-offs, behavioural drivers, and policy mechanisms needed to ensure that mattress recycling can become an integral and durable component of sustainable production and consumption systems.

3. RESEARCH METHODOLOGY

The practical part of this thesis is structured around the following research questions:

1. How is sustainability, and specifically mattress recycling, currently addressed in the mattress industry at an international and European level?
2. How familiar are consumers with eco-friendly / sustainable mattresses and mattress recycling?
3. Which factors influence consumers' mattress purchase decisions, and how does sustainability compare to comfort, durability, price, brand and other criteria?
4. To what extent are consumers willing to choose an eco-friendly mattress if it is more expensive (e.g. 10–20% price premium), and under what conditions would they participate in mattress recycling programmes?

5. What practical barriers and motivating factors do consumers identify regarding mattress recycling and sustainable mattress choices?

To answer these questions, the research applies a mixed-method approach: the literature review and expert interview provide insight into industry practices, technological options and regulatory frameworks, while the questionnaire survey examines consumer awareness, preferences and attitudes in a systematic way.

3.1 Qualitative research – Expert interview

Building on the theoretical framework, a qualitative expert interview was conducted with specialists directly involved in circular economy initiatives in the mattress sector. The goal was to gain a practical, insider view on how economic, technical and regulatory factors influence sustainable mattress production and mattress recycling in Europe, and to better understand the real-life limitations and challenges that are often overlooked in the literature.

3.1.1 Purpose of the interview

The interview served three main functions within the research:

- to validate and contextualise key themes identified in the literature review (e.g. Extended Producer Responsibility schemes, technical recycling routes, logistical barriers, business models).
- to obtain detailed insights on how circular solutions are implemented by companies in practice, including case examples.
- to identify and clarify key consumer-facing issues in the sector, such as price sensitivity, the accessibility and convenience of mattress return or collection options, and trust in sustainability-related claims, which are further examined in the quantitative survey.

3.1.2 Selection of interviewees

A purposeful sampling approach was applied: the interviewees were selected based on their professional expertise in mattress recycling, circular product design and related sustainability initiatives. The two experts work as researchers at **CSIL Milano,** an independent research institute specialising in industrial policy, sustainability, and market analysis.

Both interviewees have direct experience with:

- the assessment and development of mattress recycling schemes and circular business models.

- collaboration with producers, recyclers, policymakers and other stakeholders at European level.
- analysing European regulatory frameworks and policy instruments affecting the mattress and furniture industry.

Their profile ensured that the interview provided informed, practice-based insights into both the opportunities and the structural barriers to sustainability in the mattress industry.

3.1.3 Interview design and procedure

The expert interview followed a semi-structured format: a predefined interview questions were used as a basis, while the two specialists were encouraged to elaborate freely, reflect on the questions and bring in their own examples and perspectives. The conversation was interactive and discussion-based rather than strictly question–answer, allowing relevant topics to emerge naturally.

The key thematic modules of the interview included:

- the current state of mattress recycling in Europe.
- mechanical and chemical recycling technologies and their economic implications.
- logistical and operational challenges (collection, transport, dismantling).
- the role of regulation and Extended Producer Responsibility (EPR) schemes.
- circular business models and company practices in the mattress sector.
- perceptions of consumer behaviour and demand for sustainable mattresses.
- the potential contribution of large-scale mattress recycling to EU sustainability and landfill-reduction targets.

The interview took place on **27 October 2025** via **Microsoft Teams**, in **English**, and lasted approximately **50 minutes**. During and immediately after the interview, detailed notes were taken to ensure accurate capture of the main arguments, examples and insights.

3.1.4 Data processing and analytical approach

During the interview, detailed notes were taken to capture the specialist’s main points, explanations and examples. Immediately after the conversation, these notes were revised and edited into a concise, consistent summary to reduce fragmentation and ensure that all relevant information was accurately reflected.

The material was organised in a mainly chronological way, following the flow of the discussion, while keeping the key topics of the interview guide in focus (such as the current state of mattress recycling, technologies, logistics, regulation, business models and consumer behaviour). Practical examples and additional references mentioned by the experts were incorporated into this summary to support and contextualise the main arguments.

3.2 Quantitative research – Questionnaire survey

To complement the expert perspective and the theoretical framework, a quantitative online questionnaire survey was conducted to explore how potential consumers perceive sustainable mattresses and mattress recycling. The survey focuses on awareness, purchase priorities, willingness to pay for eco-friendly options, perceived accessibility of recycling, and factors that motivate or discourage sustainable behaviour in the mattress context.

3.2.1 Research objectives

The questionnaire was designed to:

- assess awareness of mattress recycling and eco-friendly / sustainable mattresses.
- map which factors are most important when choosing a mattress (e.g. comfort, durability, price, brand, materials, sustainability).
- measure willingness to pay a price premium for an eco-friendly mattress.
- understand how respondents perceive the difficulty of recycling an old mattress.
- identify key barriers and motivations related to mattress recycling.
- explore whether exposure to environmental or sustainability-related education is reflected in lifestyle and purchasing decisions.
- collect open-ended suggestions on how companies and policymakers could make sustainable mattresses and mattress recycling more attractive and accessible.

These objectives directly link the consumer side to the issues raised in the literature and the expert interview (information gaps, practical barriers, limited encouragements, trust in “green” claims).

3.2.2 Target group and sampling

The survey targeted individuals who are current or potential mattress buyers, primarily young adults and working-age respondents who are likely to make independent purchasing decisions and encounter sustainability-related communication.

The questionnaire was distributed online via social media platforms, university networks and personal contacts. This approach corresponds to a non-probability convenience sampling method, meaning that respondents were reached through easily accessible channels, and participation was voluntary. In several cases, the link was further shared by respondents within their own networks, creating a snowball effect.

In total, 113 completed questionnaires were collected. For the main analysis, 113 responses were retained, excluding cases where respondents left sizable parts of the questionnaire unanswered. For some individual questions, the number of valid responses is lower; in these cases, the exact number of observations (N) is indicated in the report of the results.

During the data collection process, two additional questions were added to the questionnaire following professional feedback, after approximately 30 responses had already been submitted. As a result, these questions are based on a smaller number of responses, which is also clearly reported in the results.

3.2.3 Questionnaire design

The questionnaire was structured to move from context and background to attitudes, behaviour and open feedback. It consisted of closed, Likert-scale and open-ended questions, organised into the following blocks:

1. Socio-demographic background
    - age, gender, occupation, approximate yearly gross (brutto) income, highest level of education completed, type of residence (e.g. flat, house), and location. These variables provide context for interpreting attitudes toward sustainability and potential differences between respondent groups.
2. Awareness of sustainability in the mattress industry
    - familiarity with the concept of mattress recycling.
    - awareness of eco-friendly or sustainable mattresses.
    - if aware, sources of information (e.g. brands, retailers, online content, social media, advertising, campaigns). This block captures how visible sustainability and circularity are for consumers in this specific product category.
3. Purchase decision factors and willingness to pay
    - evaluation of the importance of different factors when buying a new mattress (such as comfort, price, brand, sustainability), using rating scales.

- likelihood of choosing an eco-friendly mattress if it costs 10–20% more than a regular one. These questions operationalise the trade-off between sustainability and more traditional decision criteria.

4. Attitudes towards sustainability and circular consumption
    - statements measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), covering topics such as environmental responsibility, perceived impact of individual choices, trust in eco-labels and "green" claims, and openness to circular solutions. This block helps to position respondents along a sustainability-conscious mindset.
5. Sustainability-related education and influence on behaviour
    - whether respondents have received any kind of education, training or campaign exposure related to environmental issues or sustainability (e.g. courses, workshops, awareness campaigns).
    - if yes, how they feel this has influenced their lifestyle or purchasing decisions (closed and short open-ended responses).
6. Perceptions of mattress recycling: accessibility, barriers and motivations
    - perceived ease or difficulty of recycling an old mattress in their area.
    - main discouraging factors (e.g. lack of information, lack of collection points, time/effort, costs, uncertainty about what happens to the mattress).
    - factors that would most motivate participation in a mattress recycling programme (e.g. convenient collection, financial incentives, clear communication, retailer take-back options, guarantees of proper recycling). This block directly addresses the gap between theoretical circular models and the reality of consumer behaviour.
7. Open-ended feedback
    - what companies or governments could do to make mattress recycling and eco-friendly mattresses more attractive.
    - any additional thoughts on eco-friendly purchasing or circular consumption in general. These answers provide qualitative depth and help capture ideas or concerns that closed questions might miss.

3.2.4 Data collection procedure

The questionnaire was created using Google Forms and was available online in English during October 2025.

Before starting the survey, respondents were informed about:

- the purpose of the research.
- the approximate completion time.
- the voluntary and anonymous nature of participation.
- the use of the responses exclusively for academic purposes.

Proceeding with the questionnaire was considered informed consent.

3.2.5 Data processing and analysis

The completed responses were exported from Google Forms and processed using SPSS and spreadsheet software. First, the dataset was checked for missing values and inconsistent entries. Questionnaires with substantial missing data in key sections were excluded from the main analyses. For questions that some respondents skipped, or that were added later during the data collection process, analyses were conducted using the available valid responses; for these items, the actual sample size (N) is indicated in the presentation of the results.

The primary analytical approach was descriptive statistics. SPSS was used to calculate frequencies, percentages and, where relevant, mean values for closed and Likert-scale questions, providing an overview of awareness levels, purchasing priorities, willingness to pay, perceived barriers and motivations related to sustainable mattresses and mattress recycling. In some cases, simple distributions and figures were generated directly from the exported dataset or Google Forms outputs to support the interpretation of specific questions.

Responses to the open-ended questions were reviewed manually. Recurrent themes, concerns and suggestions were identified and summarised to complement the quantitative results with qualitative insights.

4. RESEARCH FINDINGS

4.1 Expert interview findings

The disposal of mattresses in Europe represents a significant environmental and logistical challenge, with tens of millions of units reaching the end of their life each year. This situation highlights both the scale of waste in the bedding sector and the potential value of circular production models to recover materials and reduce environmental impact.

4.1.1 Consumer willingness to pay and market segmentation

Findings from the interviews indicate that the market for sustainable or eco-friendly mattresses remains very limited at present. The expert emphasized that the primary consumers willing to engage with these products are so-called holistic buyers. These individuals approach consumption as part of a broader lifestyle, taking ethical, environmental, and health considerations into account when making purchasing decisions. They tend to be more informed about sustainability issues and are willing to pay higher prices for products that align with their values. However, this segment represents only a small fraction of the overall market, while many consumers continue to prioritize price, comfort, and brand recognition over environmental impact.

4.1.2 Differentiation and Market Positioning of Sustainable Mattresses

This situation essentially divides the market into two segments: a small, value-driven niche willing to pay a premium for sustainability, and a much larger, price-sensitive group that remains hesitant to spend more on eco-labelled alternatives. For producers, this creates both an opportunity and a challenge. On one hand, offering sustainable mattresses can serve as a form of product differentiation and help companies appeal to holistic consumers or strengthen their brand image. On the other hand, relying solely on this limited demand cannot ensure large-scale profitability, especially given that circular and sustainable production methods typically involve higher costs due to complex dismantling processes, specialized recycling technologies, and the use of bio-based or certified materials.

As a result, while the willingness to pay among holistic buyers provides some economic potential for circular business models, it remains insufficient to drive major structural change across the entire mattress industry. For the time being, eco-friendly or bio mattresses are primarily used by firms to position themselves as innovative or responsible, rather than as core products for mass market profitability. The economic success of circular approaches therefore depends heavily on whether consumer attitudes evolve toward greater environmental awareness, or whether regulatory and market mechanisms are introduced to make sustainable products more accessible and price-competitive in the future.

4.1.3 Mechanical vs. Chemical Recycling Approaches

During the interview, the expert made a clear distinction between two main approaches to mattress recycling: mechanical recycling and chemical recycling. This difference is important to understand because it significantly influences both the environmental impact and the economic feasibility of circular production models. Mechanical recycling, also sometimes referred to as a physical recycling, usually involves taking the mattress apart, separating the different materials, and then shredding or reprocessing them so that they can be used again in some form. This method is generally less complex and requires less energy, which makes it more affordable and easier to carry out on a small scale. However, the main limitation of mechanical recycling is that it often results in downcycled materials, meaning that the recovered materials are of lower quality and value compared to the original ones. For example, foam might be reused for carpet underlay or insulation, but not for producing a new mattress.

Chemical recycling, on the other hand, aims to recover materials in a way that allows them to be reused almost as if they were new. In the case of mattresses, this usually refers to the depolymerization of polyurethane foam, where chemical processes break down the polymer structure into its basic chemical components, such as monomers, which can then be used again as feedstock to create new, high-quality foam. This process allows for much higher level of circularity, as it closes the material loop and reduces dependency on virgin raw materials. However, as the interviewee explained, chemical recycling is also much more complicated and expensive. It requires specialized technology, significant capital investments, and high energy input, which makes it currently unprofitable without external financial support or regulatory incentives.

The expert emphasized that this distinction between mechanical and chemical recycling plays a crucial role in determining the economic potential of mattress recycling systems. Mechanical methods are cheaper and easier to implement, which makes them more realistic in the short terms, but they do not generate enough value to make the process truly profitable. Chemical recycling, while more promising in the long terms because it can produce near virgin materials, demands large-scale infrastructure, stable supply chains, and often some form of policy support, such as subsidies or tax benefits, to make it economically viable. At the European level, both methods are currently being tested through pilot projects and collaborative research, such as those supported by Cefic, the European Chemical Industry Council, that represents chemical companies across Europe, and other industry initiatives. These projects are still in their early stages, but they show that companies are actively experimenting with different technical routes to find the most efficient and scalable approach. Therefore, any business model within the circular mattress industry must be designed with these technical realities in mind, as the chosen recycling method will directly influence production costs, market value, and overall profitability.

4.1.4 Complexity and Logistical Barriers in Mattress Recycling

Throughout the interview, the expert emphasized several times that the physical characteristics of a mattress make its recycling process especially challenging. Unlike smaller and more uniform waste materials such as paper, plastic bottles, or glass, a mattress is a large and complex product made up of many different components. These often include textiles, metal springs, polyurethane foams, wooden frames, and various adhesives that hold everything together. Because of this complexity, mattresses cannot simply be thrown into a recycling bin or processed through standard municipal recycling systems. Their size and mixed material composition make every stage of the recycling process, from collecting to dismantling, significantly more complicated and expensive.

One of the first issues the interviewee mentioned was transportation, which plays a surprisingly large role in determining the overall cost and feasibility of mattress recycling. Because of their size, mattresses take up an enormous amount of space relative to their weight. They are light but bulky, meaning that transport vehicles quickly reach their volume capacity long before they reach their maximum weight limit. This inefficiency makes transportation expensive and environmentally costly, as fewer mattresses can be transported per trip, leading to higher fuel consumption and increased emissions. In addition, used mattresses can not be compacted or flattened easily without specialized equipment, since doing so can damage the internal components that might otherwise be recovered. This creates another layer of logistical difficulty, as collection companies must often use large trucks or make multiple trips to collect relatively small numbers of mattresses.

The problem becomes even more complex when considering collection logistics at the local level. In most cases, used mattresses are not disposed of through regular household waste systems but require separate pick-up or drop-off arrangements. This means that municipalities or private companies need to establish specific collection points or coordinate with consumers for individual pick-ups, both of which increase operational costs. In regions where no specialized collection infrastructure exists, mattresses are frequently abandoned illegally, left on streets or near waste containers, which further complicates the logistics and adds to public cleaning costs. The transportation challenge also connects directly to the issue of scale. Because there are only a few specialized recycling facilities across Europe, especially outside of countries like France or the Netherlands where take-back systems exist, mattresses often must be transported long distances before they reach a plant that can process them. The longer the distance, the higher the overall cost and the lower the environmental benefit, which undermines the economic case for recycling in the first place.

Furthermore, transport and logistics are not only expensive but also highly dependant on coordination among different actors within the recycling ecosystem. Collection companies, local authorities, and recycling facilities must work together efficiently for the system to function smoothly. If any part of this chain fails, such as delays in collection, insufficient storage space, or lack of transport vehicles, the entire process slows down, increasing costs even further. In this sense, transportation is not just a physical challenge but also an organizational one that requires a well-coordinated network and clear regulatory frameworks. The interviewee made it clear that until these logistical challenges are addressed through improved collection systems, optimized transport routes, and perhaps even regional recycling hubs that shorten travel distances, the circular recycling of mattresses will remain expensive and limited in scope.

Because of these logistical and technical challenges, mattress recycling currently remains very limited. As the interviewee pointed out, only a small percentage of mattresses that reach the end of their life cycle are recycled. In many regions where there are no dedicated collection or recycling systems in place, most mattresses still end up being either landfilled or incinerated. The existing pilot projects and small-scale recycling initiatives show promise but are still far from being economically sustainable or widespread enough to cover the entire market. This situation highlights a major structural barrier to achieving a truly circular model in the mattress industry. Unless significant improvement is made in collection logistics, dismantling technologies, and the overall efficiency of recycling operations, it will remain difficult to make large-scale mattress recycling both environmentally and economically viable.

4.1.5 The Role of Legislation and EPR Systems

During the interview, the expert placed particular emphasis on the importance of legal frameworks and their consistent implementation across countries, describing them as one of the most decisive factors in determining whether mattress recycling systems can function effectively on a large scale. The presence or absence of regulation, especially in the form of

Extended Producer Responsibility (EPR) schemes, directly influences both the financial and logistical feasibility of circular operations. EPR is a policy approach that makes producers responsible for the end-of-life management of their products, meaning that manufacturers or importers must cover the cots of collecting, transporting, dismantling, and recycling mattresses once consumers no longer use them. This approach essentially transfers part of the financial burden from municipalities and taxpayers to the industry itself, creating a dedicated funding mechanism for recycling activities. When these systems are in place and properly enforced, they not only provide stable financing for recycling infrastructure but also create a clear market signal that encourages private companies to invest in new technologies and facilities.

The interviewee highlighted France, Belgium, and the Netherlands as examples of countries where EPR or take-back systems for mattresses are already in operation. In these cases, the existence of national-level frameworks has helped establish well-structured collection networks and recycling partnerships between manufacturers, local authorities, and specialized recyclers. For instance, fees collected through EPR systems are often used to fund the logistics of collecting bulky waste, the manual dismantling of mattresses, and the development of recycling facilities. These programs demonstrate that with the right regulatory backup, mattress recycling can move from small pilot projects to an established, functioning system that supports both environmental and economic objectives. However, such progress is not yet consistent across the European Union.

In most EU member states, the legal foundation for mattress recycling is still incomplete or poorly implemented, which has resulted in a highly fragmented and uneven landscape. In countries without binding regulations or clear financial mechanisms, recycling remains limited to voluntary initiatives or small-scale experiments. This patchwork of national approaches creates uncertainty and risk for companies considering investing in large recycling plants, particularly for advanced chemical recycling processes that require significant upfront capital. Without harmonized standards or guarantees of stable material flow, firms are hesitant to commit long-term resources to the sector. The interviewee noted that this lack of regulatory alignment discourages the type of widespread industrial investment that would be necessary to make mattress recycling truly scalable across Europe.

For this reason, many actors in the industry believe that waiting for or actively advocating for stronger national and EU level requirements is essential for unblocking the next stage of circular development. A clear and consistent regulatory environment would not only help secure investment but also ensure that recycling costs are more fairly distributed through the value chain. It would also create the policy certainty needed to integrate mattress recycling into broader circular economy goals and the EU's sustainability strategies. The European Bedding Industries' Association (EBIA) and other sector organizations have already been calling for this kind of harmonization, arguing that well-designed EPR schemes and coherent legislation are preconditions for large-scale economic viability in the circular mattress industry. Until such frameworks are widely adopted, most recycling operations are likely to remain experimental and localized, rather than becoming a standardized part of Europe's waste management system.

4.1.6 Market Stability and Business Model Innovation

According to the interviewee, the mattress industry can be described as relatively stable but also somewhat stagnant in terms of growth. It is not a sector characterized by rapid innovation or fluctuating consumer demand; rather, it experiences slow, steady, and predictable development, with annual growth rates typically reported in the low single digits. This stable yet low-growing environment has two major implications for the transition toward circular and sustainable business models. First, established manufacturers face limited opportunities to expand organically, which makes it more difficult to absorb the additional costs associated with developing and producing circular products. Unlike fast-growing sectors, where companies can invest in sustainability while benefiting from increasing overall demand, the mattress market provides little room for cross subsidizing such initiatives. Second because of this limited growth, introducing sustainable or eco-friendly mattresses becomes less about capturing new markets and more about differentiation within an already mature one.

The interviewee explained that smaller or niche firms may find competitive advantage by positioning themselves as environmentally responsible and targeting the small but growing group of holistic consumers who are willing to pay more for eco-conscious products. Offering bio-based or sustainably manufactured mattresses can help these companies stand out in a crowded market where prices and comfort are otherwise the dominant decision factors. However, this strategy comes with trade-offs. While eco and bio mattresses often command higher prices, reflecting the more expensive materials, certification processes, and production methods involved, this price premium can limit accessibility for average consumers. In other words, the same factor that makes these products profitable for niche firms also restricts their potential for mainstream adoption. Most consumers remain highly price-sensitive when it comes to mattresses, especially in middle-income segment, which means that sustainable alternatives still occupy only a small share of total sales.

Several different business and pricing models are emerging as companies explore how to make circular strategies financially viable. One approach is premium differentiation, where sustainable products are marketed specifically to holistic consumers who value environmental impact and are willing to pay extra. Another is a hybrid model, which includes refurbishment or recommerce systems that allow companies to extend the products lifespan by taking back used mattresses, cleaning or repairing them, and reselling them at lower prices. This model not only reduces waste but can also capture additional revenue from existing materials. A third option, which may become more common as regulations evolve, is a cost-sharing model supported by Extended Producer Responsibility (EPR) frameworks. In such cases, producers collectively contribute to funding collection and recycling operations, spreading the costs across the industry rather than leaving them to individual firms.

Which of these models proves most sustainable and profitable in the long terms will depend on several factors, including regulatory support, the development of efficient recycling infrastructure, and the ability of manufacturers to reduce production and circularity costs through innovation and economies of scale. For now, most companies appear to be pursuing differentiation strategies as a practical short-term solution, focusing on brand positioning rather than large-scale transformation. However, as the interviewee pointed out, true market change will only occur when sustainable mattresses become more price-competitive, either through technological advances that lower production costs or through policy measures that encourage or require circular business practices. Examples of early initiatives in this area, such as those by The Furniture Recycling Group Ltd in the UK, demonstrate that with the right combination of pricing strategy, infrastructure, and regulatory support, more circular models could gradually become mainstream in the coming years.

4.1.7 The Circular Ecosystem and Stakeholder Collaboration

The interviewee emphasized that building a truly circular mattress industry requires viewing the system as an interconnected ecosystem rather than a simple chain between policymakers, manufacturers, and consumer. While these three groups are often highlighted in sustainability discussions, the expert made it clear that they represent only part of a much broader network of actors whose collaboration is essential for circularity to function effectively. This ecosystem includes recyclers, dismantlers, logistics and transportation providers, refurbisers, and downstream manufacturers that transform recovered materials into new products, such as insulation materials, carpet underlays, or even forms of furniture.

4.1.8 Digital Product Passports and Traceability (TripleR Example)

In addition, emerging players such as digital identification and product passport providers, which are companies that enable traceability and material tracking through data systems, are becoming increasingly important. Industry associations and trade bodies also contribute by establishing technical standards, facilitating cooperation, and advocating for supportive regulation. The interviewee also highlighted the growing role of such digital solutions in supporting circularity, mentioning the example of TripleR (TripleR.io), a European company that works with mattress manufacturers and other partners to develop product passport systems that record material composition and lifecycle data. Through these systems, each component of a mattress can be digitally identified, making it easier to sort, dismantle, and recycle products at the end of their use phase. This kind of traceability not only improves material recovery rates but also helps companies meet regulatory and reporting requirements related to circular economy targets. By connecting producers, recyclers, and policymakers through shared data, companies like TripleR are helping to build the digital infrastructure that can make circular mattress systems more transparent, coordinated, and economically viable.

4.1.9 Localized Circular Production (Revor Example)

The interviewee also highlighted Revor, a Belgian mattress manufacturer, as a strong example of circular economy implementation in the bedding sector. Revor's approach involves designing mattresses from only two core materials; metal and polyester, which allows for full dismantling and recycling of the product at end of life and preserves the value of the constituent materials (Revor, 2025). Another distinguishing feature is its commitment to local sourcing: the company states that many raw materials come from Belgium and that no parts need to be shipped from distant countries (Revor, 2025). This localised supply-chain strategy not only supports regional employment and craftsmanship, but also significantly reduces transport-related emissions and logistical complexity - benefits that align directly with environmental and circular-economy goals. While this model imposes cost pressures, such as higher local labour or materials cost and potential scale limitations, Revor's example demonstrates that circular mattress production can be operationalised through a combination of design innovation and localisation. The interviewee used this case to illustrate how a circular business model in the mattress industry can move beyond niche concept into a tangible market offering.

4.1.10 Fully Circular Mattress Design (Auping Example)

The interviewee also referenced Auping, a Dutch mattress manufacturer renowned for its ambitious circular production strategy, as a leading model in the bedding industry. Auping has developed fully circular mattress collections, such as the “Evolve” and “Elysium” lines - designed to be easily disassembled, entirely recyclable and produced with an eye to reuse of materials (Circle-economy.com, 2022). Notably, Auping uses joining technologies that enable separation of components and has embedded digital product passports in certain models to enhance transparency and traceability of materials (Agro-chemistry.com, 2022). In the interview’s context, Auping was cited as an example of how manufacturers can integrate circular business models, but the interviewee also pointed out that despite such innovation, challenges remain, particularly in bringing unit costs down and convincing mainstream consumers to adopt circular mattress lines at scale. Because the company remains committed to a full circular assortment by 2030, its experience offers valuable lessons on supply-chain alignment, product design for disassembly and the economics of premium versus volume production within the mattress sector.

4.1.11 Scaling Circularity in Mass Retail (IKEA and Ikano Example)

The interviewee also discussed IKEA and its supplier Ikano Industry as prominent examples of how major retailers are attempting to integrate circularity into mattress production, while also noting that challenges and limitations remain. On the positive side, IKEA has committed to producing fully circular products by 2030 and has piloted circular mattress lines that incorporate recycled or renewable foam content, demonstrating a clear strategic direction toward material recovery and reuse (IKEA, 2022) (Ingka Group, 2025). Through collaborations with entities such as RetourMatras, IKEA and Ikano are working to recover mattress foam at end of life and transform it into high-quality feedstock for new mattresses, thereby closing material loops and improving circular efficiency (INGKA, 2023), (Ikano Group, 2024) Despite these initiatives, the interviewee highlighted several challenges that limit the broader impact of these circular measures. For instance, the recycled-content targets remain modest, with only around 20 percent of foam in pilot mattresses coming from recycled or renewable sources by 2025, indicating that full circularity is still a medium-term goal (IKEA, 2022). Additionally, logistical hurdles such as sorting complex materials and the variability of take-back schemes across regions reduce the consistency of recycling efforts; in some locations, customers must pay additional fees to have their old mattresses collected (Hoskyn, 2025). At the same time, questions around material sourcing within the wider supply chain continue to impact how consumers and stakeholders perceive the authenticity of sustainability commitments. Taken together, IKEA and Ikano Industry exemplify both the opportunities and limitations that large-scale retailers encounter when attempting to implement circular mattress production. The interviewee used this case to show that while leading companies can drive progress and scale, economic, logistical, and consumer adoption barriers continue to shape the real-world outcomes of these circular initiatives.

The interviewee emphasized that the journey of a mattress through this system involves numerous stages, from the moment it reaches the end of its life to the point where its materials are ultimately reused, illustrating the complexity and multi-step nature of the recycling proces. Each stage in this process affects not only the environmental outcome but also the economic value of the recovered materials. For example, the way a mattress is collected and stored influences how easily it can be dismantled later. Similarly, the dismantling process itself determines how clean and uncontaminated the recovered materials will be, which in turn impacts their resale or reuse potential. If recyclers cannot maintain material purity, downstream manufacturers may not be able to use the recyclate for high-quality applications, reducing overall profitability. In this sense, the circular economy for mattresses is highly interdependent: the success of one actor depends on the effectiveness of all the others.

Because of these interdependencies, the interviewee argued that policies and business models need to explicitly include all participants in the ecosystem rather than focusing only on the most visible actors. For instance, Extended Producer Responsibility (EPR) systems should clearly define how financial flows move between manufacturers, collectors, recyclers, and downstream users of recovered materials. There should also be clear standards for dismantling quality and safety, as well as incentives for downstream manufacturers to incorporate recycled inputs into their production. Without such coordination, even the best recycling technology will not achieve its full potential because materials can easily become lost or downgraded at different stages of the process. In fact, many existing pilot projects in Europe have shown that coordination failures, such as unclear responsibilities, misaligned incentives, or lack of information sharing are often more significant barriers to scaling than technological limitations themselves.

Adopting an ecosystem perspective therefore means rethinking the entire flow of materials, data, and value within the mattress industry. It requires systems that connect every stage of the process through collaboration, transparency, and shared accountability. By designing policies and partnerships that recognize this interconnectedness, the industry can gradually move from fragmented pilot projects toward a cohesive circular system that functions efficiently at scale. In the long term, this ecosystem approach not only improves the environmental outcomes of mattress recycling but also strengthens its economic viability by ensuring that every actor in the chain benefits from the process.

4.2 Questionnaire survey findings

4.2.1 Sample characteristics

The final sample consists of N = 113 respondents who completed the questionnaire to a sufficient extent to be included in the analysis.

The age structure is clearly skewed towards younger respondents. The largest group is the 21–30 age category (43.4%), followed by respondents aged under 20 and 31–40, while older age groups are less represented. The 50+ segment accounts for 10.6% of the sample. This distribution reflects a respondent base that is predominantly young adult but still includes a share of more experienced consumers.

Table 1: Age distribution of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*<20*	15	13.3	13.3	13.3
	21-30	49	43.4	43.4	56.6
	31-40	19	16.8	16.8	73.5
	41-50	18	15.9	15.9	89.4
	50+	12	10.6	10.6	100.0
	Total	113	100.0	100.0	

(Own questionnaire survey, 2025)

Table 2: Gender distribution of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Male*	41	36.3	36.3	36.3
	Female	71	62.8	62.8	99.1
	Prefer not to say	1	.9	.9	100.0
	Total	113	100.0	100.0	

(Own questionnaire survey, 2025)

Table 2 shows that in terms of gender, 62.8% of respondents identified as female, 36.3% as male, and 0.9% preferred not to say.

The job-related background of the sample is diverse. A significant proportion are university students or young professionals, alongside respondents working in fields such as HR**,** sales**,** finance, management, engineering, consultancy, education, the creative sector**,** and other business roles. The presence of individuals employed in the mattress and related industries is minimal but relevant.

Table 3: Main occupation categories of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Student*	12	10.6	16.9	16.9
	HR	7	6.2	9.9	26.8
	Sales / customer-facing / marketing	17	15.0	23.9	50.7
	Management / executive	6	5.3	8.5	59.2
	Finance / consultancy / analyst / procurement	7	6.2	9.9	69.0
	Self-employed / entrepreneur / freelancer	4	3.5	5.6	74.6
	Unemployed / not working / home / family	2	1.8	2.8	77.5
	Mattress / R&D / mattress industry	4	3.5	5.6	83.1
	Other profession	12	10.6	16.9	100.0
	Total	71	62.8	100.0	
Missing	*System*	42	37.2		
Total		113	100.0		

(Own questionnaire survey, 2025

Of the 113 respondents, 71 provided information about their occupation. Among these, 16.9% were students, 23.9% worked in sales or customer-facing roles, 9.9% in HR, 9.9% in finance or consultancy related positions, 8.5% in management roles, and a small share were self-employed, unemployed, or employed in the mattress/R&D sector. The remaining respondents represented a variety of other professions, while 42 participants did not specify their occupation.

Self-reported income levels indicate that 42.5% of respondents place themselves above the average income in their country, 24.7% around the average, and 12.3% below average, while 9.6% identify as high income and 11.0% preferred not to reveal. Overall, the sample leans towards financially stable, independent consumers.

Table 4: Self-rated approximate yearly gross income of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Below average income*	9	12.3	12.3	12.3
	Around average income	18	24.7	24.7	37.0
	Above average income	31	42.5	42.5	79.5
	High income (top earners)	7	9.6	9.6	89.0
	Prefer not to say	8	11.0	11.0	100.0
	Total	73	100.0	100.0	

(Own questionnaire survey, 2025

The educational level is relatively high**:** 40.7% hold a bachelor's degree**,** 25.7% a master's degree**,** 3.5% a doctorate**,** while 29.2% reported secondary (high school) education and 0.9% selected other. This suggests a respondent group that is generally well-educated and likely familiar with sustainability converse in a broad sense.

Table 5: Highest completed education level of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*High school*	33	29.2	29.2	29.2
	Bachelor's degree	46	40.7	40.7	69.9
	Master's degree	29	25.7	25.7	95.6
	Doctorate	4	3.5	3.5	99.1
	Other	1	.9	.9	100.0
	Total	113	100.0	100.0	

(Own questionnaire survey, 2025)

Regarding housing, most participants live in apartments, either rented (30.6%) or owned (40.3%), while 27.8% live in owned houses and 1.4% in student housing or dormitories. This pattern indicates a predominantly urban and suburban sample.

Table 6: Type of current residence of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Apartment (rented)	22	19.5	30.6	30.6
	Apartment (owned)	29	25.7	40.3	70.8
	House (owned)	20	17.7	27.8	98.6
	Student housing / dormitory	1	.9	1.4	100.0
	Total	72	63.7	100.0	
Missing	System	41	36.3		
Total		113	100.0		

(Own questionnaire survey, 2025)

Geographically, respondents are mainly based in European cities, including Budapest**,** Novi Sad, Belgrade, Bucharest, and other locations in Hungary, Serbia, Romania, Croatia, Italy, the Netherlands, Belgium, Germany, the UK, Ireland, Malta, Spain and just a couple of other non-European locations. The sample is therefore international, with a strong Central and Eastern European focus, and represents consumers who are likely to encounter sustainability communication in both local and global markets.

4.2.2 Awareness of sustainable mattresses and mattress recycling

Familiarity with mattress recycling is relatively low in the sample. On a 1–5 scale (1 = not at all familiar, 5 = very familiar), 38.4% of respondents (N = 112) reported being not at all familiar with mattress recycling, and another 17.0% selected level 2. A smaller share positioned themselves in the middle (18.8% at level 3), while 13.4% chose level 4 and only 12.5% indicated that they are very familiar with the concept. Overall, the average familiarity level remains modest, indicating that for many respondents' mattresses recycling is still not a well-known or clearly understood option.

Table 7: Familiarity with the concept of mattress recycling (1–5 scale)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*1 - Not at all familiar*	43	38.1	38.4	38.4
	2	19	16.8	17.0	55.4
	3	21	18.6	18.8	74.1
	4	15	13.3	13.4	87.5
	5 - Very familiar	14	12.4	12.5	100.0
	Total	112	99.1	100.0	
Missing	*System*	1	.9		
Total		113	100.0		

(Own questionnaire survey, 2025)

In contrast, awareness of eco-friendly or sustainable mattresses is somewhat higher. Among those who answered this question (N = 112), 64.3% reported that they had heard of eco-friendly or sustainable mattresses, while 35.7% had not. This suggests that the idea of "sustainable mattresses" is more visible than the specific concept and feasibility of mattress recycling, but knowledge is still far from widespread.

Table 8: Awareness of eco-friendly / sustainable mattresses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Yes*	72	63.7	64.3	64.3
	No	40	35.4	35.7	100.0
	Total	112	99.1	100.0	
Missing	*System*	1	.9		
Total		113	100.0		

(Own questionnaire survey, 2025)

4.2.3 Factors influencing mattress purchase decisions

The results confirm that respondents primarily prioritise functional and economic factors when choosing a mattress, while brand-related aspects and environmental considerations play a more secondary role.

Comfort is by far the dominant factor. Out of the respondents who answered this item (N = 112), 67.0% rated comfort as very important and 7.1% as important, meaning that nearly three quarters place it at the top of their decision-making. Only a small interest group considered comfort moderately important or less.

Table 9: Importance of comfort when purchasing a mattress (1–5 scale)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Not important at all*	3	2.7	2.7	2.7
	Slightly important	1	.9	.9	3.6
	Moderately important	25	22.1	22.3	25.9
	Important	8	7.1	7.1	33.0
	Very important	75	66.4	67.0	100.0
	Total	112	99.1	100.0	
Missing	*System*	1	.9		
Total		113	100.0		

(Own questionnaire survey, 2025)

Price is also a key factor, but with a slightly more balanced distribution. Among valid responses (N = 111), 30.6% rated price as very important and 24.3% as important, while 27.9% viewed it as moderately important. Only a small share described price as slightly important or not important at all. This indicates that while respondents are clearly price-aware, price does not completely overshadow other considerations.

Table 10: Importance of price when purchasing a mattress (1–5 scale)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Not important at all*	3	2.7	2.7	2.7
	Slightly important	16	14.2	14.4	17.1
	Moderately important	31	27.4	27.9	45.0
	Important	27	23.9	24.3	69.4
	Very important	34	30.1	30.6	100.0
	Total	111	98.2	100.0	
Missing	*System*	2	1.8		
Total		113	100.0		

(Own questionnaire survey, 2025)

In contrast, brand reputation has noticeably lower weight. For this factor (N = 112), only 9.8% rated brand reputation as very important and 9.8% as important, whereas the majority placed it in the slightly or moderately important categories. This suggests that respondents are less driven by brand image and more by perceived product characteristics.

Table 11: Importance of brand reputation when purchasing a mattress (1–5 scale)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Not important at all*	19	16.8	17.0	17.0
	Slightly important	35	31.0	31.3	48.2
	Moderately important	36	31.9	32.1	80.4
	Important	11	9.7	9.8	90.2
	Very important	11	9.7	9.8	100.0
	Total	112	99.1	100.0	
Missing	*System*	1	.9		
Total		113	100.0		

(Own questionnaire survey, 2025)

When looking at sustainability-related aspects, the gap becomes clear. For environmental impact, based on valid responses (N = 92), most participants selected the middle of the scale: 41.3% rated it as moderately important, 28.3% as slightly important, and 22.8% as not important at all, while only 7.6% considered environmental impact very important.

Table 12: Importance of environmental impact when purchasing a mattress (1–5 scale)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Not important at all*	21	18.6	22.8	22.8
	Slightly important	26	23.0	28.3	51.1
	Moderately important	38	33.6	41.3	92.4
	Very important	7	6.2	7.6	100.0
	Total	92	81.4	100.0	
Missing	*System*	21	18.6		
Total		113	100.0		

(Own questionnaire survey, 2025)

Similarly, recyclability of the mattress is generally not seen as a decisive measure: across all respondents (N = 113), 24.8% rated recyclability as not important at all and 26.5% as slightly important, with 32.7% choosing moderately important and only 15.9% placing it in the important or very important categories.

Table 13: Importance of recyclability when purchasing a mattress (1–5 scale)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Not important at all*	28	24.8	24.8	24.8
	Slightly important	30	26.5	26.5	51.3
	Moderately important	37	32.7	32.7	84.1
	Important	14	12.4	12.4	96.5
	Very important	4	3.5	3.5	100.0
	Total	113	100.0	100.0	

(Own questionnaire survey, 2025)

4.2.4 Willingness to pay for eco-friendly mattresses

To assess whether respondents are prepared to financially support more sustainable options, they were asked how likely they would be to choose an eco-friendly mattress if it cost 10–20% more than a regular one (N = 113).

The responses are strongly mixed:

- 28.4% are reluctant: 8.0% are very unlikely and 20.4% unlikely to choose the eco option at this higher price.
- 33.6% selected the neutral option, signalling uncertainty or conditional openness.

- 38.0% expressed a positive inclination: 34.5% likely and 3.5% very likely to pay the 10–20% premium.

4.2.5 Perceptions of mattress recycling: ease, barriers and motivation

When asked how easy it is to recycle an old mattress in their area (N = 113), respondents overwhelmingly perceived the process as difficult. In total, 33.6% described mattress recycling as very difficult and 36.3% as difficult, meaning that 69.9% hold a clearly negative perception. A further 25.7% chose the neutral option, suggesting uncertainty rather than confidence. Only 3.5% considered the process easy and 0.9% very easy. Overall, mattress recycling is not viewed as an accessible or straightforward option among the respondents.

Table 14: Perceived ease of recycling an old mattress in respondents' area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Very difficult*	38	33.6	33.6	33.6
	Difficult	41	36.3	36.3	69.9
	Neutral	29	25.7	25.7	95.6
	Easy	4	3.5	3.5	99.1
	Very easy	1	.9	.9	100.0
	Total	113	100.0	100.0	

(Own questionnaire survey, 2025)

This perception is reflected in the factors that most discourage respondents from recycling a mattress (multiple answers, N = 112). The most frequently mentioned barrier is lack of information (65.2%), indicating that many people do not know where to go, how the process works, or what options exist. Almost half of the respondents (49.1%) pointed to inconvenient recycling locations.

Other factors appear less frequently but remain relevant: 25.0% mentioned the time required, 19.6% the cost of recycling, and 14.3% expressed uncertainty about whether mattress recycling genuinely benefits the environment. A small number of "other" responses reinforced similar themes, such as distrust in the system or general low awareness.

The open-ended question on what would motivate participation in mattress recycling programmes (N = 87) reveals a relatively consistent set of expectations. Most responses cluster around three main drivers:

1. Convenience and accessibility. Many respondents emphasised “easy access”, “easier process”, “making it convenient”, “someone picking it up”, or simply “knowing where to take my old mattress”. Home collection, clear drop-off points and a simple procedure were repeatedly mentioned as key conditions.
2. Information, transparency and education. A large share referred to the need for “more information”, “education”, “seeing how it works”, “trustful process”, and “awareness of the environmental impact”. Respondents want to understand what happens to the recycled mattress, whether the process is hygienic, and how it contributes to environmental protection. Transparent communication and visible campaigns are seen as crucial.
3. Incentives and benefits. Financial or tangible incentives were also frequently cited: discounts on a new mattress, vouchers, loyalty points, tax benefits, or direct compensation. Several answers explicitly linked motivation to “getting something in return” or making the sustainable option financially attractive.

4.2.6 Open-ended responses

The open-ended answers on how companies or governments could make mattress recycling more attractive (N = 86) strongly reinforce the patterns seen in the closed questions.

A large share of respondents called for more information, transparency and awareness campaigns. They want clear, accessible communication on where to bring old mattresses, how the recycling process works, and what environmental benefits it delivers.

The second dominant theme is convenience. Many respondents mentioned easier procedures, more collection points, retailer take-back options when delivering a new mattress, and preferably home pick-up.

The third recurring element is incentives. Suggestions included discounts on new mattresses, loyalty points, vouchers, tax benefits or small financial rewards for returning old mattresses. For several respondents, getting “something in return” is seen as a realistic way to shift behaviour, especially given the perceived costs and difficulty.

In addition, some answers emphasised regulation and corporate responsibility, proposing clearer rules, mandatory schemes, better product quality, and stronger involvement from producers and retailers in organising take-back and recycling systems.

Overall, the open-ended responses align closely with the quantitative results: people are not fundamentally against mattress recycling, but expect it to be simple, visible, trustworthy and worthwhile before they fully engage with it.

5. EVALUATION

Sustainability in the mattress industry is not primarily held back by consumers rejecting the idea, but by a gap between their interest and the realities they face: limited information, difficult and inconvenient recycling options, and the perception that sustainable choices and proper mattress disposal are complicated and often more expensive.

The expert interview reflected a cautious view: sustainable mattresses and recycling are still niche, and consumers are perceived as largely unwilling to pay more or change behaviour. The survey partially challenges this. While comfort and price remain the dominant decision factors, a notable share of respondents is open to choosing an eco-friendly mattress even at a 10–20% price premium, and many express willingness to participate in mattress recycling under the right conditions. This does not mean the market is "ready", but it clearly shows more potential than industry actors may assume.

At the same time, the data make the core obstacle very clear: people do not know enough, cannot see where to act, and do not feel supported by the system. Most respondents perceive mattress recycling as difficult, lack concrete information on where and how to do it, and face inconvenient options. Sustainable mattresses are more known than mattress recycling itself, but often framed lightly, which weakens trust and perceived value.

Beyond the consumer perspective, the research also shows that the feasibility of a circular mattress system depends on three interconnected structural conditions: product design, the wider ecosystem, and regulation. The complex, multi-material construction of most mattresses makes dismantling and recycling technically difficult and expensive, which limits what can realistically be recovered. The ecosystem around mattresses - producers, retailers, logistics, dismantlers, recyclers and downstream users of secondary raw materials are still fragmented, so even where solutions exist, they are not yet aligned or scaled. Finally, stable and well-designed regulatory frameworks, such as Extended Producer Responsibility schemes, are essential to secure predictable funding, clear responsibilities and long-term investment in recycling infrastructure. Where these elements are missing or only partially developed, even motivated consumers and innovative companies face practical limits.

From this perspective, the evaluation of the current situation is straightforward:

- there is undeveloped willingness, but it is fragile and conditional.
- without reliable communication, clear recycling routes and realistic incentives, this willingness will not translate into action.
- the responsibility cannot be pushed onto individuals alone.

Therefore, based on the results, three key directions emerge as necessary:

1. Stronger and clearer communication. Companies and public actors should make mattress recycling and sustainable mattress options visible, specific and understandable: what it means, how it works, where to go, and why it matters.
2. Practical, built-in solutions. Recycling should be integrated into the purchasing process (take-back with delivery, clear collection points), so that participation requires minimal extra effort.
3. Supportive regulatory and incentive frameworks. Stable regulation, Extended Producer Responsibility schemes, and simple incentives (discounts, trade-ins, vouchers) can shift behaviour without placing the full burden on consumers.

Measured against these directions, the current state of the mattress industry is incomplete but not hopeless. The technical and policy tools are already emerging, and the survey results show that consumers are more open to sustainable mattresses and recycling than often assumed.

6. SUMMARY AND CONCLUSION

This research examined how sustainability appears in the mattress industry from three angles: existing literature and industry data, expert insight from practitioners working on circular solutions, and consumer attitudes captured through an online questionnaire. Together, these elements provide a realistic picture of where the sector currently stands and what is still missing for mattress recycling to move beyond ecological niche status.

The literature review and expert interview confirmed that the environmental case for mattress recycling is clear: mattresses are bulky, long-lived, multi-material products that create significant waste, but they also contain valuable materials that can be recovered. Technological solutions exist or are developing (mechanical recycling, advanced chemical processes, new design concepts, digital product passports), and policy tools such as Extended Producer Responsibility schemes are starting to prove effective where implemented. At the same time, the expert perspective highlighted persistent barriers: complex product design, expensive logistics, limited and unstable end-markets for recyclates, and uneven or incomplete regulation across countries.

The questionnaire results show that consumers are not the main obstacle in the simplistic sense of “nobody cares”. Respondents clearly prioritise comfort, durability and price, which is expected for a product like a mattress, but sustainability is present as a secondary consideration rather than completely absent. A notable share is open to choosing an eco-friendly mattress even at a 10–20% price premium, especially if quality and credibility are guaranteed. However, awareness of mattress recycling is low, the process is widely perceived as difficult, and the main reasons for not participating are very concrete: lack of information, lack of convenient options, uncertainty about what happens to the returned mattress, and concerns about extra effort or cost.

Regarding the practical barriers and motivating factors, the results show that people are not opposed to sustainable choices but are blocked by how inconvenient and unclear the system currently is. Most respondents find mattress recycling difficult or very difficult, do not know where or how to do it, and are discouraged by lack of information, inconvenient or unknown collection points, the time and effort required, and the assumption that it may cost extra. At the same time, they highlight very specific conditions under which they would participate: easy and integrated solutions (such as take-back when a new mattress is delivered or accessible drop-off points), trustworthy information about what happens to the recycled mattress and its environmental impact, and simple incentives like discounts, vouchers or loyalty schemes. This confirms that practical design, visibility and support largely determine whether willingness turns into real action.

Overall, the findings suggest that the key problem is not a lack of abstract “green values”, but a gap between willingness and reality. Consumers show potential openness; the industry and policymakers are experimenting with solutions; but the system that should connect these sides is still incomplete. For sustainable mattresses and mattress recycling to become normal rather than exceptional, the sector needs straightforward communication, integrated take-back and recycling options built into the purchase process, stable and enforceable regulatory frameworks, and simple incentive schemes that support consumers. Within the limits of its scope, this research suggests that progress in the mattress industry depends on designing systems that make sustainable options clear, accessible and trustworthy, so that choosing them becomes a realistic and straightforward part of the mattress purchasing and disposal process.

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APPENDICES

Appendix I: Questionnaire

Q1: Age

<20

21-30

31- 40

41- 50

50+

Q2: Gender

Male

Female

Prefer not to say

Q3: Occupation

(open ended question)

Q4: How would you describe your approximate yearly gross (bruto) income?

Below average income (less than typical in my country)

Around average income

Above average income

High income (among the top earners)

Prefer not to say

Other

Q5: Education level

High School

Bachelor's Degree

Master's Degree

Doctorate

Other

Q6: What type of residence do you currently live in?

Apartment (rented)

Apartment (owned)

House (rented)

House (owned)

Student housing or dormitory

Q7. Location (City/Country)

(open ended question)

Q8: How familiar are you with the concept of mattress recycling?

Please rate on a scale from 1 to 5.

1. Not at all familiar
2. Slightly familiar
3. Moderately familiar
4. Familiar
5. Very familiar

Q9: Have you ever heard of eco-friendly or sustainable mattrasses?

Yes

No

Q10: If yes, where have you learned about them?

Online advertising

Retail stores

Friends/family

Environmental campaigns

Other

Q11: When buying a new mattress, how important are the following factors to you?

Please rate each factor on a scale from 1 to 5.

1. Not important at all
2. Slightly important
3. Moderately important
4. Important
5. Very important

Factors rated:
- Comfort
- Price
- Brand reputation
- Environmental impact
- Recyclability

Q12: How likely are you to choose an eco-friendly mattress if it costs 10–20% more than a regular one?
Please select one option:
- Very unlikely
- Unlikely
- Neutral
- Likely
- Very likely

Q13: Please indicate how much you agree with the following statements.
Use the scale below for each statement:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Statements:
- I feel responsible for reducing my environmental impact.
- Recycling or buying eco-friendly products makes me feel good about myself.
- I trust companies that promote sustainability.
- I believe one person's effort can make a difference.

Q14: Have you ever received any education or training related to environmental sustainability? (e.g., courses, workshops, campaigns)
Please select one option:
- Yes

- No

Q15 (if Q14 = Yes): How has that education influenced your lifestyle or purchasing decisions?
Please select one option:

1. Not at all
2. Slightly
3. Moderately
4. Strongly

Q16: Please indicate how much you agree with the following statements (rate each on a 1–5 scale).

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Statements:
- I understand the environmental impact of mattress disposal.
- Learning about sustainability encourages me to recycle or reuse products.
- I am more likely to buy eco-friendly products after learning about their benefits.

Q17: What kinds of educational content or campaigns would most motivate you to recycle mattresses?
Select all that apply:
- Online videos
- Social media posts
- Community workshops
- Retail promotions
- School or university programs

Q18: How easy do you think it is to recycle an old mattress in your area?
Please select one option:
- Very difficult

- Difficult
- Neutral
- Easy
- Very easy

Q19: What factors most discourage you from recycling a mattress?

Select all that apply:

- Lack of information
- Inconvenient recycling locations
- Time required
- Cost of recycling
- Not sure how it benefits the environment
- Other: __________

Q20: Please rate your agreement with the following statements (1–5 scale as above).

Statements:

- I would recycle my mattress if the process was convenient.
- I would pay extra for eco-friendly disposal if I knew it helped the environment.
- I believe mattress recycling has real environmental benefits.
- The government or retailers should make recycling options easier.

Q21: What would most motivate you to participate in mattress recycling programs?

(Open-ended)

Q22: In your opinion, what could companies or governments do to make mattress recycling more attractive?

(Open-ended)

Q23: Any additional thoughts on eco-friendly purchasing or circular consumption?

(Open-ended)

Appendix II: Interview guide

1. Economic feasibility

What business and pricing models could make sustainable mattress production profitable while maintaining market competitiveness?

How does consumer willingness to pay for sustainable products affect the economic potential of circular business models in the mattress industry?

What are the main economic barriers and cost drivers influencing mattress recycling and circular production?

2. Large-Scale Implementation

What logistical and infrastructural challenges currently limit large-scale mattress recycling (in the EU)?

What forms of collaboration between policymakers, manufacturers, and consumers are most effective for implementing circular systems in the mattress sector?

What role do national governments and local authorities play in coordinating collection and recycling infrastructures for mattresses?

How can awareness campaigns, certification systems, and eco-labelling help integrate mattress recycling into mainstream consumer behaviour at scale?

How can large-scale mattress recycling contribute to achieving the EU's 2035 landfill-reduction targets and the broader Green Deal objectives?