

# INTEGRATING COMPANIES INTO THE CIRCULAR ECONOMY

CASE STUDIES and A ROADMAP



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# INTEGRATING COMPANIES INTO THE CIRCULAR ECONOMY

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“

The competitive landscape of the future will be shaped not by those who consume more resources, but by those who create greater value from existing resources.

”

## EXECUTIVE SUMMARY

The linear economy model, which became widespread with industrialization, is based on the extraction of natural resources, their use in production, their consumption, and their eventual transformation into waste. This model, which can be described as “take-make-use-dispose,” has facilitated mass production and access to products. However, the dependence of economic growth on the continuous use of new resources has increased environmental pressures, raw material costs, and supply risks. Global indicators also suggest that this structure is not sustainable. According to the United Nations Environment Programme (UNEP), natural resource extraction has more than tripled over the past fifty years, and if current trends continue, it is expected to increase by 60% by 2060.

The problem is not limited to consuming greater quantities of resources and the resulting increase in waste generation. The loss of the economic value embedded in products, components, and materials after use also constitutes a structural loss. Introduced as a solution to this problem, the “Circular Economy” aims to keep products, materials, and components within the economic system at the highest possible level of value and for as long as possible.

In a circular economy, the fate of products after use is largely determined during the design, material selection, and production stages. Durable, repairable, reusable, and easily separable products help preserve economic value. Maintenance, repair, reuse, refurbishment, remanufacturing, take-back systems, and reverse logistics practices enable products to be brought back into the economic system.

### A New Competitive Threshold for Companies

For companies, the circular economy is not merely a matter of environmental responsibility or regulatory compliance. It is an alternative economic model that reduces resource costs, strengthens companies’ position within supply chains, creates new revenue opportunities, and supports market access.

In addition, reducing production losses, using secondary raw materials, reintegrating waste into production processes, and extending product lifespans can reduce companies’ dependence on primary resources. In this way, companies can become more resilient to fluctuations in raw material prices and supply disruptions. In particular, as regulations in the European market require companies to restructure their product design, data management, and supplier relationships, they may create new revenue models for companies that align their operations with these requirements.

## Türkiye's Circular Economy Agenda

Türkiye's circular economy policy agenda initially focused on developing recycling infrastructure, recording waste, and strengthening institutional capacity for waste management. One of the key policy documents in this process was the National Recycling Strategy Document and Action Plan (2014–2017). Rather than imposing direct and comprehensive obligations on companies, the Strategy primarily set the direction for public policy in areas such as developing the regulatory framework, strengthening recycling infrastructure, increasing financial support, and recording waste.

**Table 1. Türkiye's Circular Economy Agenda<sup>1</sup>**

|           |                                                                                                                                                                                                           |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2014–2017 | <b>National Recycling Strategy Document and Action Plan</b><br>The first policy document to link recycling with economic value creation -54 actions.                                                      |
| 2016–2023 | <b>National Waste Management and Action Plan</b><br>Waste management analysis across 81 provinces; planning of facility and investment needs.                                                             |
| 2019      | <b>Zero Waste Regulation</b><br>Systematic waste management at the institutional and company level; principles governing the Zero Waste Certificate.                                                      |
| 2021      | <b>Green Deal Action Plan</b><br>9 main headings, 32 objectives, and 81 actions. It extended the circularity agenda to products, trade and finance.                                                       |
| 2023–2033 | <b>Water Efficiency Strategy Document and Action Plan in the Framework of Adaptation to the Changing Climate</b><br>Industrial water efficiency, water recovery, and cleaner production techniques.       |
| 2025–2035 | <b>National Waste Management Strategy and Plan</b><br>Regional planning across eight regions; projections to 2035 by waste type.                                                                          |
| 2025–2028 | <b>National Circular Economy Strategy and Action Plan (UDESEP)</b><br>7 priority sectors, 6 strategic goals, and 53 actions – the key policy document guiding Türkiye's transition to a circular economy. |
| 2026      | <b>Deposit Management System (DOA) – Nationwide</b><br>Implemented across all 81 provinces and 973 districts; the refund amount is increased to TRY 1 per eligible container.                             |
| 2026–2035 | <b>National Water Plan</b><br>8 goals, 31 strategies, and 141 actions.                                                                                                                                    |
| 2026–2028 | <b>Medium-Term Programme</b><br>Industrial symbiosis, eco-design legislation, and the Green Transformation Support Program.                                                                               |

The Zero Waste Project, the most visible initiative related to the circular economy in Türkiye, was launched in 2017. With the publication of the Zero Waste Regulation on 12 July 2019, it was transformed into a regulatory framework setting out the principles for the establishment, implementation, and monitoring of the zero waste management system, as well as for zero waste certificates. The Project is based on preventing wastage, using resources more efficiently, separating waste at source, and recovering waste. For companies falling within the scope of the Regulation, defining responsibilities, assessing the current situation, establishing separate collection infrastructure, informing employees, monitoring waste data, and carrying out the certificate application process have become part of their corporate operations. Throughout the Project, implementation guidelines were prepared for different types of institutions, organizations, and businesses, such as municipalities, hospitals, schools, universities,

<sup>1</sup> The documents included in the table were compiled using the official websites of the Ministry of Environment, Urbanization and Climate Change, the Ministry of Trade, the Ministry of Agriculture and Forestry, and the Presidency of Strategy and Budget.

workplaces, hotels, restaurants, and similar entities, supporting the expansion of the zero waste management system to different fields of activity. According to data from the Ministry of Environment, Urbanization and Climate Change, the recovery rate, which stood at 13% in 2017, increased gradually to 37.53% in 2025. The national recovery target for 2053 has been set at 70%.

The 2025–2028 National Circular Economy Strategy and Action Plan (UDESEP), in turn, moves the circular economy into a holistic policy framework. Focusing on seven priority sectors, the Plan sets out six strategic goals and 53 actions and links circular economy policies to Türkiye's 2053 Net Zero Emissions target. Rather than treating the circular economy solely as an approach focused on increasing recycling capacity, the Plan offers a broad scope of implementation, ranging from product design to sectoral transformation and from incentive mechanisms to monitoring systems. According to statements by the Ministry of Environment, Urbanization and Climate Change, the measures set out in the Plan are expected to generate TRY 210–350 billion in value added annually and create more than 100,000 jobs.

The first direct step in water management was the Water Efficiency Strategy Document and Action Plan in the Framework of Adaptation to the Changing Climate (2023–2033), which entered into force in 2023. The document places particular emphasis on industrial water efficiency, the recovery of used water, cleaner production techniques, and the implementation of sectoral guidelines. For companies, this approach reinforces the need to measure and monitor water consumption, set efficiency targets, and incorporate investments in water recovery into production planning.

The National Water Plan (2026–2035), published in 2026, expanded the scope of water management within a broader policy framework. The Plan provides a long-term roadmap for the sustainable management of water resources in terms of both quality and quantity, the strengthening of water security, and adaptation to climate change. The National Water Plan is based on seven fundamental principles established with due consideration of international best practices and Türkiye's experience in water management. The Plan comprises 8 main goals, 31 strategies, and 141 actions. Key areas of focus include water efficiency, water reuse practices, basin-based management, digital and data-driven water management, and the water-energy-food-ecosystem nexus.

In the coming period, the impact of the transition is expected to become particularly pronounced among SMEs and at the lower tiers of supply chains. Investment in resource-efficient technologies, access to recycled inputs, digital tracking of material flows, a qualified workforce, and long-term financing will be among the key needs of companies. Türkiye's success in the transition to a circular economy will depend on the extent to which policy objectives can be integrated into companies' investment, data management, and business model decisions.

## Objectives and Methodological Approach

In Türkiye, the circular economy is no longer an agenda item that companies can afford to ignore. At a time when resource costs are steadily rising, supply chains are becoming more fragile, and international competition is growing fiercer, the circular economy is one of the key areas of transformation that directly affect companies' future competitiveness. Companies that use energy, water, and raw materials more efficiently, turn waste back into economic value, and extend the useful life of products not

only reduce their costs but also open up new revenue streams. Access to new markets, enhanced export capacity, increased brand value, and a stronger position within global value chains are the key benefits that this transformation offers to companies.

The transition to a circular economy represents a multilayered transformation rather than a linear and obstacle-free process. Throughout this transition, companies face simultaneous challenges across a range of areas, including investment needs, access to finance, technological capacity, a qualified workforce, and regulatory compliance. Accordingly, while progress in a single area is not sufficient on its own to carry the entire process, setbacks in different areas can slow the overall pace of transformation.

For this reason, insights from the field are needed not only by companies seeking to take their first steps towards a circular economy, but also by those that have already implemented certain practices yet struggle to carry them into a holistic transformation approach. A roadmap is essential to make visible which practices deliver results, which steps progress with more difficulty than expected, where companies encounter challenges, and which tools and approaches can be used to develop solutions. This is because, alongside success stories, companies also need information on the hesitations, false starts, costs incurred, and lessons learned during the transformation process. A genuine and, most importantly, functional roadmap can only be developed by detailing not only successes but also challenges and learning processes in a holistic manner.

On the other hand, in order to increase value-added production, strengthen export potential, ensure compliance with international standards—particularly European Union regulations—and safeguard the competitiveness of industry, it is necessary to understand the realities on the ground in all their dimensions and reflect them in policy design. Policy recommendations developed without identifying how companies perceive the circular economy, what motivates them to engage in this transition, which practices they have implemented, and at which stages they encounter difficulties will fall short of meeting on-the-ground needs. Similarly, support mechanisms designed without taking into account companies' needs and expectations regarding access to finance, technical assistance, and the removal of regulatory barriers are unlikely to yield effective, lasting outcomes. The ability of policy to connect effectively with realities on the ground depends on an accurate understanding of companies' actual needs, capacities, and decision-making processes.

This report goes beyond providing a superficial snapshot of the current situation. Its purpose is to make realities on the ground visible, to understand the transformation companies are undergoing through their own experiences, and to build a solid foundation for Türkiye's circular economy journey based on findings from the field. Within this framework, the report provides a comprehensive analysis of companies' approaches to and motivations for the circular economy, the practices they have implemented, the structural factors that slow the transformation, and the support they need in order to make progress.

On this basis, site visits were conducted to observe first-hand the experiences of enterprises that have successfully integrated circular economy practices into their corporate strategies and operational processes, and to examine their transformation practices. During these visits, companies' production and operational processes were directly observed, the practices they had implemented were examined in detail, and the views of participants who have steered the transformation process were gathered through face-to-face, semi-structured interviews.

A multiple-case study approach was adopted in this research. Each company included in the study was treated as an independent case, and its circular economy journey was examined within its own sectoral and organizational context. Subsequently, recurring trends and patterns across the companies were analyzed, and diverging practices and common needs were identified. In this way, while the distinctive experience of each company was made visible, common findings that may provide guidance for different sectors were also drawn out.

Given the Istanbul Chamber of Commerce's role as an umbrella organization representing a wide range of sectors, the research was not limited to specific sectors. Instead, heterogeneity was ensured in the sample in order to bring together different production structures and organizational experiences. Accordingly, a total of 10 companies operating in the fields of aluminum, iron and steel (2), paper and board (2), textiles (2), automotive spare parts, packaging, and industrial metal production participated in the study. The companies were selected through purposive sampling, with the development of concrete circular economy practices in energy, water, or waste management as the primary selection criterion. Companies using digital technologies to measure, monitor, or further develop these practices were also included within the scope of the research.

The fieldwork was conducted between November 2025 and March 2026. Interviews were carried out with companies' general managers, plant managers, sustainability and environmental managers, R&D managers, and relevant specialist experts. The interviews lasted between 25 and 120 minutes, with an average duration of 45 minutes. Based on audio recordings made with the participants' consent and the researchers' notes, a primary dataset of approximately 150 pages was compiled. The field findings were further supported by companies' sustainability reports, corporate websites, publicly available news sources, and corporate documents shared with the research team.

Throughout all stages of the research, the principles of personal data protection, confidentiality, and corporate privacy were observed. Each company was anonymized using codes such as "Case A" and "Case B." To prevent the companies' corporate identities from being determined directly or indirectly, certain identifying profile information was deliberately omitted from the report. The same care was taken with regard to the names and distinctive characteristics of the projects undertaken by the companies.

Two important points should be noted at this stage. First, the fieldwork was not limited solely to the companies included in the final case analyses; a broader group of companies was contacted. However, cases that did not provide sufficient, consistent, and analyzable data on the research questions, or whose interview content fell outside the study's scope, were not included in the final analysis. The research team is grateful to these companies for the time they devoted to the study and for their contributions through sharing their experiences.

The second important point is that the information presented in the study is based on information communicated to the research team and on data compiled from secondary sources. In reporting company statements, the research team sought to maintain analytical distance and to assess the findings within the limitations of the available data. When presenting the relevant data, promotional or unverified statements that could heighten the risk of greenwashing were avoided, and a cautious reporting language was deliberately adopted.

## Key Circular Economy Practices Adopted by Companies

The circular economy practices implemented by the companies examined in the report, along with the tangible benefits they generate, are summarized in the case cards. Each card presents the companies' motivations for pursuing the transition, their key practices, and the main challenges they encountered, alongside key takeaways that may serve as a reference for other companies.

Figure 1. Case Cards

|                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                  |
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| <p><b>CASE A</b></p> <p><b>Aluminum Sector</b></p> <p><i>An established industrial company with extensive experience in the aluminum sector, offering a broad product portfolio and maintaining a strong export presence.</i></p>                   | <p>As energy constitutes one of the biggest cost items, it has been a key driver of the company's energy-efficiency-oriented transformation since the 2000s. The establishment of the Energy Management Department and the early deployment of an energy monitoring system laid the foundation for this transformation.</p> <ul style="list-style-type: none"> <li>Under the Energy Efficiency Improvement Project (VAP) Support Program, the replacement of 10,000 conventional lamps with LED lighting resulted in approximately 30% electricity savings.</li> <li>Through a melting furnace project implemented in partnership with a European partner, a 30% efficiency improvement was achieved through burner optimization, together with a 10% improvement associated with slag reduction.</li> <li>A recuperator system reduced flue gas temperature from 800°C to 150°C, enabling waste heat recovery.</li> <li>An 8.6 MW trigeneration plant was integrated with an AI-supported decision-making system.</li> <li>Rolling oil recovery resulted in savings of 1,200 tonnes, while acid recovery generated monthly savings of 35,000 tonnes.</li> </ul> | <p><b>Key Challenge</b></p> <p>The company's success is underpinned by the understanding that risks become manageable to the extent they can be measured, and by strong support from senior management.</p>                                                                                                      |
| <p><b>CASE B</b></p> <p><b>Iron &amp; Steel Sector -1</b></p> <p><i>An iron and steel producer that uses 100% electrical energy in the melting process and primarily serves the domestic market.</i></p>                                            | <p>Dependence on imported critical raw materials and supply chain vulnerabilities have made waste recovery a strategic priority.</p> <ul style="list-style-type: none"> <li>Through the refractory recovery project, approximately 20% of the material was recovered, resulting in savings of 1,200 tonnes of bauxite, 1.2 million kWh of electricity, and 65,000 Sm<sup>3</sup> of natural gas.</li> <li>Zirconia nozzle waste was separated and reintroduced into production or returned to the supply chain.</li> <li>Flue dust was sold to licensed companies, while slag was directed to the cement and road construction sectors under by-product certification.</li> <li>Wastewater recovery met 47.5% of total water consumption in 2021, while the grey water footprint was reduced to zero.</li> <li>Through the digital twin project, decision-making processes were made less dependent on individual employees.</li> </ul>                                                                                                                                                                                                                          | <p><b>Key Challenge</b></p> <p>While management is based on the PDCA (Plan-Do-Check-Act) cycle, which has supported successful implementation, employee integration into the process has emerged as the biggest challenge.</p>                                                                                   |
| <p><b>CASE C</b></p> <p><b>Iron &amp; Steel -2</b></p> <p><i>An export-oriented producer of steel profiles and high-quality steel products, with over 70 years of industry experience, using 100% domestically sourced scrap in production.</i></p> | <p>The transformation has been driven by three complementary factors: a proactive management approach, evolving customer demands, and employee feedback.</p> <ul style="list-style-type: none"> <li>99.9% of steelmaking waste and 98% of rolling mill waste were recovered through licensed recycling companies.</li> <li>Energy audits led to the elimination of the tundish drying process, resulting in savings of 28% in water consumption and 40% in natural gas use.</li> <li>The SCADA system enabled remote monitoring and management of energy consumption.</li> <li>During the trial phase of the wastewater recovery project, approximately 31,395 m<sup>3</sup> of water, equivalent to around 20%, was recovered over a two-month period.</li> <li>Automation and robotics in the packaging department reduced the physical workload on employees.</li> </ul>                                                                                                                                                                                                                                                                                      | <p><b>Key Challenge</b></p> <p>Constraints on renewable energy investments arising from CBAM regulations, together with logistical challenges and regional infrastructure gaps, limit the ability to achieve sustainable stakeholder engagement.</p>                                                             |
| <p><b>CASE D</b></p> <p><b>Paper &amp; Cardboard Sector -1</b></p> <p><i>A mid-sized paper and cardboard manufacturer with nearly half a century of industry experience, operating on a production model based entirely on recycled paper.</i></p>  | <p>The company's long-standing presence in the industry, combined with strong public-private sector collaboration, has positioned it not merely as a follower of regulatory developments but as an active contributor to their shaping.</p> <ul style="list-style-type: none"> <li>Biogas production is integrated into the facility, with daily use of approximately 5,000 m<sup>3</sup> generating monthly natural gas cost savings of around TRY 1.4 million.</li> <li>Wastewater is treated to levels well below discharge limits, with COD (Chemical Oxygen Demand) reduced to approximately 150 mg/L; around 80% of the treated water is recovered and reused.</li> <li>High-calorific-value pulper waste is sent to licensed facilities for energy recovery, while the installation of an RDF (Refuse-Derived Fuel) unit is being planned.</li> <li>For 17 years, source-separated collection was managed directly by the company, with approximately 1,300 recycling units and 300 collection bins installed.</li> </ul>                                                                                                                                 | <p><b>Key Challenge</b></p> <p>Ensuring consistent quality control of waste paper is a major challenge, particularly as raw material accounts for approximately 60% of total costs. The collection and sorting of waste paper require significant manual effort, making the process operationally demanding.</p> |
| <p><b>CASE E</b></p> <p><b>Paper &amp; Cardboard Sector -2</b></p> <p><i>An export-oriented company with nearly 50 years of industry experience, using waste paper as the primary raw material in more than 90% of its production.</i></p>          | <p>Energy, water, and raw material efficiency are positioned as both environmental responsibilities and key drivers of long-term competitive advantage.</p> <ul style="list-style-type: none"> <li>A 4 × 5.5 MW cogeneration system provides an annual electricity generation capacity of 193 million kWh, with surplus electricity sold to the grid.</li> <li>25% of the treated wastewater from the wastewater treatment plant is reused.</li> <li>Through R&amp;D-supported lightweighting initiatives, cardboard with equivalent strength is being developed using less raw material.</li> <li>Energy consumption is monitored in real time on a process-by-process basis through digital systems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Key Challenge</b></p> <p>Some investments have been postponed due to financial constraints, while limited awareness of available incentive mechanisms and shortages of qualified experts have posed additional challenges.</p>                                                                             |

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| <p><b>CASE F</b></p> <p><b>Textile Sector -1</b></p> <p><i>An integrated textile company with an international brand portfolio, operating across dyeing, digital printing, transfer printing, and garment manufacturing processes.</i></p>                             | <p>The transformation process was initially driven by the sustainability requirements of international brands and EU regulations, and later evolved into a more proactive approach with the establishment of an R&amp;D Center and a dedicated Sustainability Department.</p> <ul style="list-style-type: none"> <li>Nearly all electricity demand is met through rooftop solar and wind energy.</li> <li>Yarn cones have been made reusable up to 4-5 times through a vacuum extraction system.</li> <li>Under the waste traceability project, waste streams are barcoded and linked to the Digital Product Passport (DPP).</li> <li>A comprehensive water map has been developed, while wastewater separation initiatives are being carried out in collaboration with start-ups and universities.</li> </ul>                                                                                                      | <p><b>Key Challenge</b></p> <p>Brand requirements—such as recycled content targets and reduced water or carbon footprints—can conflict with one another, creating technical and operational trade-offs.</p>                                                                                                                         |
| <p><b>CASE G</b></p> <p><b>Textile Sector -2</b></p> <p><i>A small-scale producer specializing in leather and fur suede for the garment, footwear, and leather goods industries, with an international brand portfolio.</i></p>                                        | <p>The transformation has been shaped largely by the regular auditing and certification requirements of international brands.</p> <ul style="list-style-type: none"> <li>Following certification audits, machinery was repositioned closer to the hot water source, and a regular maintenance routine was established.</li> <li>Rooftop solar panels were installed to increase the use of renewable energy.</li> <li>Production waste—including fat, salt, wool, and leather trimmings—is redirected to industries such as gelatin, candle manufacturing, fertilizer production, and textile filling materials.</li> <li>Water use is planned in line with the Organized Industrial Zone (OIZ) quota; groundwater is not used due to certification requirements.</li> </ul>                                                                                                                                        | <p><b>Key Challenge</b></p> <p>Changing brand requirements create uncertainty in investment planning, while the ability to meet these demands depends not only on the company's own capacity but also on the infrastructure available within the Organized Industrial Zone.</p>                                                     |
| <p><b>CASE H</b></p> <p><b>Automotive Spare Parts Sector</b></p> <p><i>A well-established distributor in the automotive aftermarket, working with both domestic and international suppliers.</i></p>                                                                   | <p>Awareness initially emerged from the General Manager's personal commitment and was later institutionalized following the company's participation in the COP (Conferences of the Parties) Summit.</p> <ul style="list-style-type: none"> <li>Waste corrugated cardboard and paperboard were processed into packaging filler material, resulting in approximately 2.5 tonnes of savings in one year, with a target of achieving zero waste by 2026.</li> <li>Pallet dimensions were optimized, increasing container capacity from 24 to 28 pallets and generating savings equivalent to approximately one container for every six shipments.</li> <li>Through shipment consolidation for supplies from China, 32 shipments were reduced to just 2.</li> <li>Conventional plastic bags were replaced with a durable box system made from recycled plastic, with a target of reducing plastic use by 80%.</li> </ul> | <p><b>Key Challenge</b></p> <p>Encouraging employees and stakeholders to adopt changes in their daily habits, while limited awareness of available support mechanisms remains an ongoing issue.</p>                                                                                                                                 |
| <p><b>CASE I</b></p> <p><b>Packaging Sector</b></p> <p><i>A pioneering manufacturer developing reusable nonwoven carrier bags as an alternative to single-use plastic bags, with an integrated approach that combines product, machinery, and software design.</i></p> | <p>The anticipation, in the early 2000s, that plastic bags would face increasingly stringent restrictions became the key driver behind the transformation of the company's business model.</p> <ul style="list-style-type: none"> <li>Production scraps and plastic granule waste are reprocessed into granules and reused in bag manufacturing.</li> <li>Ultrasonic welding technology enables production without sewing thread, improving the recyclability of the final product.</li> <li>Patented modular machinery can produce between 20 and 110 bags per minute, with energy and compressed-air consumption optimized for greater resource efficiency.</li> </ul>                                                                                                                                                                                                                                            | <p><b>Key Challenge</b></p> <p>The classification of the company's products under the same HS (Harmonized System) code as conventional plastic bags limits their visibility in export statistics and access to public support mechanisms, while also making it more difficult to compete with low-cost single-use plastic bags.</p> |
| <p><b>CASE J</b></p> <p><b>Metal Industrial Manufacturing Sector</b></p> <p><i>A large-scale, export-oriented manufacturer specializing in aluminum alloy wheels and supplying major global automotive manufacturers.</i></p>                                          | <p>Circular economy practices are increasingly linked to access to finance, while the European Green Deal and expectations from major automotive manufacturers remain the primary external drivers.</p> <ul style="list-style-type: none"> <li>Through the Energy Management System, energy consumption is monitored at department and equipment level, with variance analyses conducted to identify inefficiencies.</li> <li>Up to 100% of aluminum machining chips are recycled and reintroduced into the production cycle.</li> <li>Alternative material trials are being conducted for wheel covers using materials derived from olive pits and discarded fishing nets.</li> <li>A scrap-tracking software system enables traceability by product model, customer, and defect type.</li> </ul>                                                                                                                  | <p><b>Key Challenge</b></p> <p>The company's free zone status limits access to certain incentive schemes, while sustainability audits are extending across the supply chain, increasingly affecting SME-scale suppliers as well.</p>                                                                                                |

## Common Enablers of Success

When the cases are assessed holistically, several common factors that determine the success of circular economy practices stand out. Foremost among these is the integration of circularity into companies' core business activities, making it part of the organizational structure. Rather than treating circular economy practices as isolated environmental projects, the companies examined have made them an integral part of their production, management, and decision-making processes. In this context, organizational mechanisms such as energy management departments, sustainability committees, environmental units, and R&D structures have been established, strengthening the transformation's footing within the company. As a result, circularity is no longer a field of work left to the responsibility

of a single unit; it has spread across the company's various functions and core decision-making processes, from production to maintenance, procurement to logistics, and quality to finance.

One of the strongest commonalities across the cases is the emphasis placed on measurement and monitoring capacity. Energy monitoring systems, digital twin applications, AI-supported forecasting tools, meters, sensors, barcode systems, and scrap-tracking software have enabled companies to monitor resource flows in considerable detail. Thanks to strong data infrastructure, companies have been able to determine how much energy, water, and material is used by each department, piece of equipment, product, or order, and areas where inefficiencies are concentrated have been made visible. Prioritizing intervention and investment decisions based on these data has made it possible to regularly measure the impact of the practices implemented, compare results, and turn the knowledge gained into organizational learning. One of the most prominent findings of the case analyses is that, without strong measurement and monitoring capacity, it is difficult to manage resources systematically and to establish circular transformation on a lasting and scalable basis.

Preventing energy and material losses before they occur and reintegrating materials and by-products generated during production back into the process have created significant economic benefits for companies. Prominent examples include the recovery of waste heat, the remelting of metal chips, the return of refractory materials and nozzles to production, the reuse of rolling oil, the reutilization of paper and packaging materials, and the repeated use of durable boxes and transport containers within circular systems. These practices demonstrate that, when waste is not regarded merely as a cost item to be disposed of, it can become a new source of raw materials, savings, and value added for companies.

In most of the cases, the transformation appears to have begun either with awareness that developed within senior management or on the initiative of specific managers. Senior management's ownership of the transformation is of decisive importance for allocating resources, establishing the necessary organizational structures, and sustaining long-term investments. However, the institutionalization and permanence of the transformation also depend on employees' active participation in the process. New waste separation methods, maintenance procedures, digital data entry, and logistics arrangements directly affect employees' responsibilities and daily work habits. In some cases, employee resistance was found to slow the spread of practices, showing that circular transformation cannot be sustained solely through targets set by senior management and that employee buy-in and participation are also decisive for the process.

Therefore, corporate targets set from the top down need to be designed together with bottom-up participation mechanisms that incorporate employees' experiences and suggestions into the process. Incentive mechanisms through which employees can submit improvement suggestions, monitor the results of practices, and benefit as much as possible from the resulting gains strengthen the adoption of the transformation across the company. In particular, involving shop-floor staff in the process makes it easier to adapt practices that seem sound in theory to operational conditions on the ground and helps overcome organizational blind spots in existing processes. In particular, involving frontline employees helps adapt theoretically sound practices to operational conditions and helps overcome forms of operational blindness that may develop within established routines and processes.

The cases also indicate that initiating the transformation through small-scale, measurable practices with observable outcomes within a relatively short period is an effective approach. Making the cost savings and efficiency gains generated by initial initiatives visible within the organization helps

strengthen employees' and managers' confidence in, and ownership of, the transformation process. The gradual scaling of successful pilot initiatives across other departments and facilities can also help reduce the organizational resistance that may arise from large-scale, high-cost changes. This approach demonstrates that the transition to a circular economy should be understood not as a one-off major investment decision, but as a long-term transformation process built around a continuous cycle of measurement, implementation, learning, and improvement.

## Circular Economy Practices from a 5R Perspective

The circular economy practices implemented by the companies were not examined solely in descriptive terms. They were also systematically classified and interpreted using the R-strategies widely used in the circular economy literature. These strategies, which aim to preserve the value of products, components, materials, and resources within the economic system for as long as possible, are also referred to as “resource value retention options.” The main purpose of applying the R-framework is to compare company practices across sectors and scales within a common analytical framework and to identify the areas of circularity where these practices are concentrated.

In this report, the R0-R9 framework developed by José Potting, Marko Hekkert, Ernst Worrell, and Aldert Hanemaaijer (2017) has been adapted to the scope of the case analysis and grouped into five main categories: **Rethink**, which refers to reconsidering the need for a product or service and redesigning the way it is used; **Reduce**, which involves reducing the consumption of energy, water, and raw materials; **Reuse**, which aims to extend the useful life of products, components, and equipment; **Recycle**, which refers to converting waste into secondary raw materials; and **Recover**, which refers to the recovery of energy or heat from waste that cannot be recycled. When a practice could be associated with more than one strategy, classification was based on the practice's primary objective and dominant value-retention mechanism.

**Table 2. Classification of Companies' Circular Economy Practices within the R-Strategies Framework**

| Cases  |  Rethink |  Reduce |  Reuse |  Recycle |  Recover |
|--------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Vaka A |                                                                                             | ✓                                                                                          |                                                                                           | ✓                                                                                             | ✓                                                                                             |
| Vaka B |                                                                                             | ✓                                                                                          | ✓                                                                                         | ✓                                                                                             | ✓                                                                                             |
| Vaka C |                                                                                             | ✓                                                                                          |                                                                                           | ✓                                                                                             | ✓                                                                                             |
| Vaka D |                                                                                             | ✓                                                                                          | ✓                                                                                         | ✓                                                                                             | ✓                                                                                             |
| Vaka E |                                                                                             | ✓                                                                                          |                                                                                           | ✓                                                                                             | ✓                                                                                             |
| Vaka F |                                                                                             | ✓                                                                                          | ✓                                                                                         | ✓                                                                                             |                                                                                               |
| Vaka G |                                                                                             | ✓                                                                                          | ✓                                                                                         | ✓                                                                                             |                                                                                               |
| Vaka H |                                                                                             | ✓                                                                                          | ✓                                                                                         | ✓                                                                                             |                                                                                               |
| Vaka I | ✓                                                                                           | ✓                                                                                          |                                                                                           | ✓                                                                                             |                                                                                               |
| Vaka J |                                                                                             | ✓                                                                                          |                                                                                           | ✓                                                                                             |                                                                                               |

**Reduce** practices are concentrated in areas such as lowering energy and water consumption, preventing production losses, using more efficient equipment, improving processes through automation, reducing packaging consumption, and increasing logistics capacity. These practices generally focus on reducing resource use and operational costs without fundamentally altering the existing production structure. Since they are typically low-risk, measurable, and capable of generating short- to medium-term results, they can also be regarded as an initial step in the transition toward a circular economy.

The **Recycle** strategy is observed across all cases examined. Examples include reintegrating scrap, production waste, waste paper, metals, plastics, process water, and other residual materials into production, or redirecting them for use as secondary raw materials in other sectors. In some companies, recycling serves as a complementary waste-management activity, whereas in others it has become an integral part of the raw-material sourcing model and production system. The development of material flows across companies and sectors not only reduces waste disposal costs but also creates opportunities to generate additional revenue through the sale of by-products.

The **Reuse** and **Recover** strategies are identified in approximately half of the cases examined. The Reuse strategy is observed in practices such as extending the service life of machinery and equipment through maintenance and repair, reusing packaging and delivery equipment, and retaining auxiliary production materials within the system while preserving their functional value. As these practices do not require extensive value transformation, they tend to be more visible among small- and medium-sized enterprises.

**Recover** practices are concentrated primarily among medium- and large-scale companies with energy-intensive operations and relatively advanced technical infrastructure. Prominent examples include the use of waste heat to generate steam or hot water, the use of biogas as an energy source, and the conversion of energy-containing waste streams into alternative fuels. The fact that the Recover strategy is identified in a more limited group of companies can be attributed to the need for a certain production scale, suitable waste profiles, adequate technical infrastructure, and sufficient investment capacity.

The **Rethink** strategy, which occupies the highest level of the circularity hierarchy, is identified in only one case. By fundamentally reconsidering a product's function, mode of use, value proposition, and consumption pattern, this strategy represents one of the most advanced and transformative dimensions of the circular economy. Its limited presence among the cases examined indicates that companies' circular economy efforts remain predominantly focused on process innovation. By contrast, more comprehensive forms of product innovation aimed at transforming product design, usage models, and consumption patterns appear to be less developed.

The case analyses assessed within the 5R framework indicate that companies' circular economy practices are not distributed uniformly across the different strategies. Factors such as resource intensity, production technology, company size, investment capacity, and the degree of control over material flows play a significant role in determining which strategies become more prominent. In energy- and water-intensive sectors, efficiency improvements and resource recovery are more prevalent, whereas small- and medium-sized enterprises more frequently emphasize reuse, life-extension practices, and operational flexibility. Accordingly, the transition to a circular economy should be understood not as a standardized model, but as a gradual transformation process shaped by each company's production structure, operational characteristics, and organizational capacity.

## Primary Motivations Driving Companies Towards a Circular Economy

The interview findings indicate that companies mostly do not turn to circular economy practices in pursuit of a direct, predefined "circular economy objective." Rather, in the cases examined, the practices are seen to be shaped by the intersection of multiple factors, including customer expectations, regulatory developments, cost pressures, resource dependency, operational risks, and management awareness. Accordingly, the transformation progresses as a gradual process: it begins with the recognition of a specific pressure or opportunity, gains traction within the company, and evolves into concrete practices as the necessary technical and managerial capacity is developed.

**Tablo 3. Companies' Motivations for the Circular Economy**

| Motivations                                | Pressures                                                                                                                                                                                                                                            | Incentives                                                                                                                                                                                                                                    |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>External Pressures &amp; Incentives</b> | <ul style="list-style-type: none"> <li>Brand/Customer Pressure</li> <li>Certification and Audit Pressure</li> <li>International Agreements and Regulations</li> <li>Market Access and Competitive Pressure</li> <li>Supply Chain Pressure</li> </ul> | <ul style="list-style-type: none"> <li>Funding and Project Incentives</li> <li>Collaboration and Partnerships</li> <li>International Networks and Knowledge Flows</li> <li>Sectoral Platforms</li> <li>Brand Reputation/Visibility</li> </ul> |
| <b>Internal Pressure &amp; Incentives</b>  | <ul style="list-style-type: none"> <li>Cost Pressure</li> <li>Operational Risk</li> <li>Raw Material Dependency</li> <li>Labour Shortage and Employee-Related Risks</li> </ul>                                                                       | <ul style="list-style-type: none"> <li>Proactive Management and Early Awareness</li> <li>Organizational Ownership</li> <li>R&amp;D and Technical Capacity</li> <li>Corporate Identity</li> </ul>                                              |

Note: Although the motivations are grouped for analytical purposes, they may overlap and interact in practice.

Among external motivations, the most prominent factor is the growing sustainability expectations of international brands and customers. In particular, for exporting companies, firms working with international brands, and businesses integrated into global supply chains, environmental performance is becoming an increasingly important consideration in supplier selection. Criteria such as energy and water consumption, waste management, the use of recycled content, carbon footprint, traceability, and resource efficiency are now assessed alongside traditional commercial criteria such as product quality, price, and delivery performance.

The interviews also indicate that customer and brand expectations extend beyond environmental performance. Social criteria—including employee wages, working conditions, women's rights, employee engagement, corporate social responsibility activities, and companies' relationships with the regions in which they operate—are also increasingly incorporated into supplier evaluation processes.

Brand and customer requirements that initially emerge as expectations may gradually become binding through certification requirements, audits, and supplier assessment criteria. Across the cases examined, certifications have evolved from being voluntary tools for corporate development into prerequisites for establishing or maintaining commercial relationships with customers. At the same time, the findings indicate that certification demands are not always driven by sufficient knowledge or awareness. In some cases, customers request certifications without a clear understanding of their scope

or the type of transformation expected from the supplier, but rather in response to market trends and a desire to avoid falling behind competitors.

International agreements and carbon-related regulations also constitute some of the strongest external pressures on companies. The European Green Deal, the Carbon Border Adjustment Mechanism (CBAM), carbon reporting obligations, and broader climate policies directly shape the management agendas of companies operating in, or supplying to, the European market.

Accordingly, a company's carbon performance is no longer merely an environmental indicator; it has become an operational and financial risk factor closely linked to production costs, market access, and competitiveness. A participant from Case A, operating in the aluminum sector, described this situation as follows:

*“The European Green Deal and Paris Climate Agreement caused a very dramatic change in the management style and perspective of companies doing business with Europe. Because otherwise, you reach a point where you are no longer able to sell your products.”*

**(Case A)**

It is noteworthy that some companies have initiated carbon footprint calculations, verification processes, and product-level environmental performance documentation without waiting for regulatory requirements or customer demands to emerge. By doing so, these companies have avoided a purely reactive response to regulation and have prepared in advance for potential future cost and market risks. This approach has not only strengthened their capacity to adapt to regulatory developments but has also enhanced their credibility and competitive position in the eyes of customers.

Circular economy criteria have therefore moved beyond being a source of differentiation and have increasingly become a form of market-entry qualification. Companies that adapt to these criteria at an early stage gain an advantage in retaining existing customers and accessing new markets, while those that fail to make the necessary investments face risks such as customer loss, declining competitiveness, and exclusion from certain markets. For export-dependent small- and medium-sized enterprises in particular, such adaptation has increasingly become a matter of ensuring business continuity. A participant from Case G, operating in the textile sector, described this situation as follows:

*“... If we had not taken these steps, we might now have been one of the companies that had shut down. Because our path forward in terms of competitiveness would have been completely blocked.”*

**(Case G)**

The external environment does not function solely as a source of pressure on companies. Funding schemes, project support mechanisms, university-industry collaborations, sectoral platforms, and international knowledge networks also serve as important incentives that facilitate corporate transformation. Programs such as TÜBİTAK (*The Scientific and Technological Research Council of Türkiye*), European Union funds, Eureka, and Eurostars have played a notable role in supporting projects related to energy efficiency, carbon reduction, waste management, and the development of circular products. These forms of support provide companies with more than financial resources. The project development process also helps firms define their technical challenges more clearly, establish performance targets, build partnerships with different institutions, and make project outcomes measurable.

Among internal motivations, reducing the costs of energy, water, raw materials, and auxiliary inputs emerges as a primary driver. Particularly in energy- and resource-intensive sectors, efficiency initiatives are often motivated not initially by environmental concerns, but by the need to control production costs, maintain price competitiveness, and sustain profitability. Monitoring energy consumption, calculating product-level costs, comparing production lines, and identifying areas of loss encourage companies to invest in measures that generate both economic and environmental benefits.

A similar approach is observed among companies with water-intensive production processes. Treating and reusing water, as well as investing in closed-loop systems, is important not only for reducing environmental impacts but also for managing rising water and treatment costs. At the same time, given the potential difficulties with future water access, such investments also help safeguard production continuity. As a participant from Case D in the paper and cardboard sector stated, *“Just as one kilogram of raw material has value, every drop of water matters...”* This statement clearly illustrates the economic importance of resource use from the company’s perspective.

Raw material dependency and supply chain vulnerabilities also play an important role in the development of circular practices. Companies dependent on imported inputs are particularly exposed to price volatility, logistical disruptions, geopolitical developments, and difficulties in accessing critical raw materials. A concrete example is Case I, a reusable bag manufacturer that responded to supply shortages during the COVID-19 pandemic by reusing its own production scraps. The resulting product is now particularly preferred in the U.S. market.

Difficulties in accessing qualified labor, concerns related to employee health, and the risk of human error in operations are also among the internal pressures driving investment in technology. Robotics and automation are used particularly in physically demanding and repetitive tasks to reduce employees’ physical workload, improve occupational safety, and safeguard production continuity. Digital monitoring and AI-supported systems, meanwhile, enable processes to become faster, more measurable, and more traceable. These investments help reduce error rates and production losses while enabling more effective management of resource use and decision-making processes.

One of the most significant findings of the study is the decisive role of senior management support in initiating, institutionalizing, and scaling circular economy practices across the organization. In companies that identify future regulations, cost pressures, and market risks early, institutional structures in areas such as energy management, carbon management, sustainability, and R&D tend to be established earlier.

Proactive companies do not wait for explicit customer demand or for regulatory requirements to become mandatory. Instead, they monitor emerging technologies, market trends, and regulatory developments in advance and establish measurement, reporting, and verification infrastructures at an early stage. Such an approach enables companies to adapt to changing conditions with greater preparedness and at a lower cost.

## Key Bottlenecks and Priority Needs for Advancing the Circular Transition

Although the challenges companies face in their circular economy journey vary across sectors and firm sizes, a holistic assessment shows they are largely concentrated in financing, regulation, infrastructure, supply chains, human resources, and technical capacity. Accordingly, companies' expectations and needs point not to isolated, independent support measures but to an integrated, complementary transformation ecosystem that addresses multiple areas simultaneously.

**Table 4. Challenges and Expectations of Companies in the Circular Economy**

|                                                                                                                           | Challenges                                                                                                                                                               |   | Needs and Expectations                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------|
| <br><b>Financial and Regulatory</b>      | Macroeconomic vulnerability, regulatory inconsistencies (CBAM ↔ national legislation), and difficulties in accessing finance.                                            | → | Access to financial incentives and green finance, regulatory compliance, and policy coordination.                       |
| <br><b>Infrastructure and Technology</b> | Energy and water infrastructure constraints, limited measurement and monitoring capabilities, and quality and standardization issues related to secondary raw materials. | → | Water and energy efficiency infrastructure, data and measurement systems, and support for digitalization.               |
| <br><b>Capacity and Collaboration</b>  | Organizational resistance, shortages of skilled labor, limited access to knowledge and laboratory infrastructure, and brand- and competition-related pressures.          | → | Training and human capital development, technical capacity and research infrastructure, and supply chain collaboration. |

Note: Although the three dimensions are presented separately for analytical purposes, they may overlap in practice. For example, an investment in digitalization may simultaneously address infrastructure, financing, and technical capacity needs.

All of the companies interviewed stated that Türkiye's macroeconomic conditions directly affect their capacity to invest in circular economy initiatives. Inflation, exchange-rate volatility, rising energy and raw material costs, difficulties in accessing finance, and global competitive pressures constrain companies' investment capacity. These conditions affect not only large-scale investments such as renewable energy systems, water recovery infrastructure, and production-line modernization but may also delay critical early-stage measures such as installing meters, collecting machine-level data, and digitally monitoring production processes.

Financial capacity constraints are particularly pronounced among SMEs. While large companies may be able to initiate certain investments through stronger equity positions, specialized experts, and greater experience in project development, SMEs often struggle to cover high upfront costs and manage uncertainty about investment payback periods. Companies, therefore, expect financial support mechanisms to be designed in differentiated forms that take into account firm size, investment capacity, and implementation constraints.

While large-scale investors emphasize the need for long-term, affordable, and predictable green finance instruments, SMEs expect support programs with lower application thresholds, easier access, and faster decision-making processes. Companies also expect incentive schemes to cover not only

comprehensive transformation projects, but also modular investments such as energy and water meters, sensors, process monitoring systems, small-scale equipment upgrades, and resource-efficiency measures. In addition, the erosion of the real value of Turkish lira-denominated support over the course of long-term projects due to inflation is another significant concern raised by companies.

One of the areas in which companies face the greatest difficulty is the misalignment between international regulations and Türkiye's national regulatory and incentive frameworks. The European Green Deal, the Carbon Border Adjustment Mechanism (CBAM), carbon reporting requirements, renewable energy use, import regimes, and product classifications directly influence investment decisions, while existing national regulations do not always provide sufficient support for this transition. This misalignment is particularly evident in energy-intensive sectors, where the conditions required for renewable energy use to be recognized within CBAM-related carbon calculations may not fully correspond with Türkiye's energy regulations. Even when companies are willing to invest in renewable energy, issues related to direct consumption, netting arrangements, land availability, transformer capacity, and grid connection can limit the expected carbon-reduction benefits of such investments. As a result, investments that may be technically and financially feasible can be delayed or prevented by regulatory uncertainty.

Another important challenge is that existing classification systems do not always adequately recognize new and circular products. Treating reusable products under the same classification as single-use alternatives can obscure their environmental attributes and place companies at a disadvantage in export procedures, access to support mechanisms, and sectoral representation. Similarly, incentive criteria that do not sufficiently account for the actual environmental contribution of investments may prevent companies from receiving the expected level of support for wastewater treatment and resource recovery projects.

In this context, companies expect national regulations to become more closely aligned with international obligations, while also becoming simpler, more practical, and better adapted to sector-specific production conditions. Greater predictability regarding when new regulations will enter into force and what their scope will be is considered essential for more effective investment and production planning. Interviewees also emphasized that revenues generated through Türkiye's Emissions Trading System should be used in ways that directly support the green transformation of industry.

All manufacturing companies interviewed consider water scarcity to be an increasingly significant strategic risk. Investments in water recovery, closed-loop systems, rainwater harvesting, and advanced treatment technologies are therefore among their key priorities. In some Organized Industrial Zones (OIZs), treated water can be supplied back to companies, whereas this option is unavailable in others, creating differences in resource costs and production security. Companies, therefore, expect shared treatment and water-recovery systems to be expanded at the OIZ level, access to treated water to be improved, and regional water-management plans to be developed.

In the energy sector, renewable energy investments remain constrained by financing conditions, land availability, connection capacity, and permitting procedures. Rooftop solar installations, particularly in energy-intensive facilities, can meet only a limited share of total energy demand. Companies therefore call for the development of models that support self-consumption, the strengthening of grid and transformer capacity in industrial zones, and improved access to larger-scale renewable energy investments.

Measurement and digital monitoring infrastructure also constitute critical components of the transition. The inability to monitor energy, water, waste, emissions, and production data at the process or machine level makes it difficult for companies to identify inefficiencies and determine investment priorities. In large companies, the complexity of production systems is a major source of this challenge, while in SMEs, the main constraints are cost and limited technical capacity. Companies, therefore, expect digitalization support to be designed in a more modular manner and tailored to their actual needs. Relatively small investments, such as meters, sensors, machine-level data collection systems, and basic reporting software, should also be included in support schemes, particularly for SMEs. Companies further emphasize the need to incorporate measurement infrastructure at the design stage of new facilities and to gradually improve it in existing facilities through phased investments.

For companies, recycled raw materials must be clean, properly separated, traceable, and predictable in terms of their technical characteristics. Variability in the quality of waste paper, textiles, plastics, and other secondary inputs increases production costs, requires additional quality-control processes, and may affect the quality of final products. The inability to collect sufficient quantities of suitable-quality material in the domestic market also increases reliance on imported inputs. Companies, therefore, expect source-separation systems to be strengthened, deposit and collection schemes to be expanded, and reliable quality standards to be established for secondary raw materials.

The development of industrial symbiosis opportunities is another priority highlighted by companies. Although the production residue of one company may constitute a valuable input for another sector, difficulties in identifying appropriate partners, uncertainty regarding the technical characteristics of materials, and logistics costs can limit the use of this potential. Companies, therefore, expect Organized Industrial Zones (OIZs), chambers of commerce and industry, and sectoral organizations to play a more active role in platforms that match the supply of waste and by-products with potential demand.

The interviews further indicate that circular transformation is shaped not only by technical investments but also by employee behavior and organizational culture. New separation systems, data collection practices, material standards, and logistics models directly alter employees' daily working routines. Resistance during this process is associated not only with limited knowledge, but also with the difficulty of abandoning established working practices and the perception that new procedures create additional workload. Companies, therefore, emphasize the need to complement technical investments with training, on-site implementation support, employee participation, and performance-management mechanisms. Clear ownership of the transformation by senior management, effective communication of its purpose, and incentives for employee contribution can accelerate organization-wide adoption.

Demand for specialized expertise is also increasing in areas such as energy management, carbon accounting, sustainability reporting, resource efficiency, and digital monitoring. For SMEs in particular, maintaining all of these capabilities in-house is often not feasible. Companies, therefore, identify a need for practical training programs, shared pools of experts, affordable consultancy services, and structures similar to model factories focused specifically on circular economy practices.

Finally, general announcements about available funds and incentives are insufficient to meet companies' needs. Some firms report being unaware of relevant support mechanisms, while others lack qualified expert to manage application, project writing, and reporting processes. In this context, ministries, professional chambers, and sectoral organizations are expected to assume a more active role by assessing companies' needs, guiding firms toward appropriate support instruments, and providing practical guidance throughout project development and implementation.

Reliance on foreign organizations for environmental analysis, chemical compliance, product testing, and certification services increases companies' costs and delays implementation. The fact that some domestic institutions are not recognized by certain global brands can also require companies to repeat the same tests abroad. In this context, companies emphasize the need to strengthen university-industry collaboration, sector-specific research centers, accredited laboratories, and internationally recognized domestic certification systems.

The changing and, at times, conflicting requirements of international brands also create considerable pressure on companies. Improvements in one environmental indicator may generate new challenges in another, while customers are often perceived as focusing on individual performance indicators rather than on overall environmental impact. The requirement to meet different testing, certification, and audit criteria for each customer also creates recurring costs and additional administrative burdens. Companies, therefore, highlight the need for widely recognized certification systems, mutual recognition of audits, and customer criteria grounded in scientifically based life cycle assessments.

Countries such as China, Vietnam, India, Egypt, and Morocco, which benefit from comparatively lower production costs, also exert significant competitive pressure on companies. Interviewees particularly noted that China has strengthened its position in global competition through national policy support and incentive mechanisms that enable products to be offered at lower prices, making it difficult for Turkish companies to compete in international markets. The interviews also emphasized that competing solely on price is becoming increasingly difficult for producers in Türkiye, while high-quality, low-carbon, innovative, and sustainable products are becoming increasingly critical for export competitiveness:

*“Türkiye’s only chance of salvation lies in producing value-added and sustainable products. Production alone is not enough; it has to be value-added, and it has to be sustainable.... If we can achieve this type of production, then we can already extend it to every area.”*

**(Case A)**

The needs identified by companies are concentrated around access to finance, regulatory predictability, shared energy and water infrastructure, reliable data systems, high-quality secondary raw materials, practical guidance, human capital, and domestic technical capacity. From the companies' perspective, accelerating the transition depends on the coordinated development of support and coordination mechanisms across these areas.

## Circular Economy Roadmap for Companies

There is no single, standardized formula for transitioning to a circular economy that can be applied uniformly across all companies. Each company differs in terms of resource use, production technology, product structure, organizational capacity, export profile, geographic location, customer expectations, and influence across the value chain. Accordingly, a transformation priority for one company may be of secondary importance for another.

For example, in an energy-intensive sector, energy efficiency and waste heat recovery may constitute the most critical elements of the transition, whereas in a water-intensive sector, wastewater recovery

ery may be more important. For this reason, rather than proposing a fixed timetable or a rigid sequence of implementation priorities, this report introduces the eight-step “DÖNGÜSEL Model”, which is designed to progress in line with each company’s level of organizational maturity.<sup>1</sup>

Figure 2. “DÖNGÜSEL Model” for Companies



The eight steps of the model should not be viewed as independent stages or as steps that are completed only once. New data, implementation outcomes, technological developments, regulatory changes, and evolving stakeholder expectations may require a company to revisit an earlier stage of the process. In this way, the cycle is reassessed at each iteration, targets are updated, and the company progressively advances to a higher level of circular maturity.

“**Asses**”, ensures that companies begin their transformation journey from a clear understanding of their own circumstances. Before pursuing new technologies, investments, or ambitious targets, companies need to determine where, to what extent, and at what efficiency energy, water, raw materials, and other critical resources are being used. A sound transformation program cannot be developed without first making production losses, material waste, points of waste generation, data gaps, and organizational capacity constraints visible. At this stage, companies should conduct a self-assessment not to benchmark themselves against other organizations, but to establish their own baseline. The assessment should cover areas such as strategy and governance, measurement and data, operational processes, 5R practices, product design, digital capacity, employee engagement, supply chains, financing, and verification, ultimately providing the company with a reliable baseline inventory.

“**Prioritize**”, is based on the recognition that not every area can be transformed simultaneously. A circular economy agenda should not generate an unlimited portfolio of projects; rather, it should focus on the areas that offer the greatest environmental, economic, and strategic value to the company. Prioritization should therefore consider not only environmental impact but also potential economic savings, resource criticality, supply risks, customer expectations, regulatory pressures, investment requirements, and technical feasibility. The identified priorities should then be translated from broad intentions into concrete, measurable targets. Instead of general objectives such as “reducing energy consumption” or “increasing recycling,” companies should clearly define the baseline value, base year, target rate, target date, responsible manager, required investment, calculation methodology, and verifi-

<sup>2</sup> The original Turkish term “DÖNGÜSEL,” which corresponds to “circular” in English, is retained to preserve both the conceptual meaning of the model and the acronym formed by its eight sequential steps.

cation approach. In this way, circular economy objectives move beyond statements of intent and become a genuine management domain linked to corporate budgets, investment decisions, and performance systems. Companies at an early stage of the transition can begin decision-making with a limited but reliable set of data. At this stage, they may draw on familiar financial indicators such as return on investment (ROI), total cost of ownership (TCO), avoided procurement costs, and reductions in waste disposal costs.

**“Monitor”**, is based on the principle that what cannot be measured cannot be effectively managed. Aggregate electricity, natural gas, and water bills may reveal overall trends, but they do not explain where or why losses occur. Resource flows should therefore be monitored, wherever feasible, at the facility, department, production line, equipment, and product levels. Measurement infrastructure should initially focus on areas where consumption and the risk of losses are highest. Measurement alone, however, is not sufficient. Meters, sensors, SCADA (Supervisory Control and Data Acquisition) systems, digital twins, tracking software, and AI-supported solutions should not be used merely to collect data or generate reports. These systems should be capable of defining normal consumption ranges, identifying deviations, anticipating maintenance and failure risks, and providing managers with actionable intervention options.

**“Develop”**, Develop requires companies to restructure their project portfolios in line with the 5R hierarchy: Rethink → Reduce → Reuse → Recycle → Recover. This hierarchy emphasizes the prioritization of practices that preserve the economic value of products and materials at the highest possible level and for as long as possible. Recycling should therefore not be regarded as either the starting point or the sole indicator of a circular economy. The primary objective should be to prevent waste before it is generated, reduce resource consumption, improve product durability, repair components, and enable materials to be reused. Before initiating a new project, companies should ask: “Before sending this product or material for recycling, can its use be avoided, its quantity reduced, or the material reused?”

**“Take Ownership”**, emphasizes that the circular economy is not solely the responsibility of environmental or sustainability departments. Production, maintenance, procurement, R&D, quality, logistics, sales, finance, human resources, and senior management should all share responsibility for the transformation. Unless clear ownership is established at senior management level and circular economy targets are integrated into corporate strategy, budgeting, investment, procurement, and performance-management systems, circularity will remain a peripheral activity outside core corporate decision-making. Employee participation is equally critical at this stage. Companies should establish mechanisms through which employees can report problems, propose solutions, participate in pilot initiatives, and observe the benefits generated. Training should not be limited to conceptual awareness; it should provide practical guidance on what needs to change, why it needs to change, and how to implement the change. In this way, circularity can evolve from the agenda of a dedicated project team into a shared way of working across the organization.

**“Go Beyond Organizational Boundaries”**, is based on the recognition that a fully circular system cannot be established within a single company. The use of secondary raw materials, reusable packaging, product take-back systems, reverse logistics, and industrial symbiosis all require the participation of suppliers, customers, logistics providers, public institutions, universities, and other stakeholders. Within this framework, suppliers should be regarded not merely as entities subject to audits or sanctions, but as partners in the transformation. Capacity should be developed across the value chain

through joint improvement plans, technical assistance, data sharing, and collaborative projects. Customers should likewise be involved at an early stage in the design of product take-back, reuse, maintenance, repair, and reverse-logistics systems. A system that is complex, costly, or time-consuming from the customer's perspective is unlikely to achieve widespread adoption, even if it is technically successful.

**“Scale Up Impact”**, bridges the gap between pilot initiatives and organization-wide transformation. Pilot projects enable new technologies and approaches to be tested with limited risk. However, the success of a pilot does not in itself mean that transformation has been institutionalized. Successful outcomes must be incorporated into standard operating processes, investment criteria, procurement requirements, technical procedures, and employees' daily workflows. Results should be reviewed regularly by senior management and translated into new targets in accordance with the PDCA (Plan-Do-Check-Act) approach. Successful practices should subsequently be scaled across production lines, facilities, product groups, and suppliers.

**“Communicate”**, refers to communicating outcomes in a transparent, credible, and evidence-based manner. Sharing circular economy practices with customers, employees, investors, and financial institutions can strengthen a company's credibility and reputation. Communication, however, should never precede implementation, measurement, and verification. The base year, scope, system boundaries, calculation methodology, limitations, and verification status for reported targets and outcomes should be clearly stated. Generalizing the results of a limited pilot project to the entire company or selectively communicating only positive indicators may generate short-term visibility but can lead to a loss of credibility and increase the risk of greenwashing over the longer term. Within the DÖNGÜSEL Model, communication should therefore be centered not on slogans but on evidence, and not on claims but on verifiable results. Internal communication is equally important. Making achieved improvements visible to employees can strengthen organizational ownership and encourage the development of new project ideas.

In conclusion, the most important contribution of the DÖNGÜSEL Model lies in its ability to break down a complex and long-term transformation process into steps that are understandable, manageable, and measurable for companies. Circularity is not a privilege accessible only to companies with large budgets, advanced technologies, or extensive teams of specialists. Any company that can ask the right questions, identify its critical areas, act on reliable data, and learn from small-scale initiatives before scaling them up can begin this transformation.

When the report's case studies, motivation analyses, and maps of challenges and needs are considered together, the message is clear: for companies in Türkiye, the question should no longer be, “Should we transition to a circular economy?” but rather, “How quickly, systematically, and sustainably can we make this transformation a lasting part of the organization?”

# ŞİRKETLERİN DÖNGÜSEL EKONOMİYE ENTEGRASYONU

## CASE STUDIES and A ROADMAP

The circular economy has become one of the key areas of transformation directly affecting companies' competitiveness, from resource efficiency and supply security to cost management and market access. Prepared by İTOSAM, this report, titled "Integrating Companies into the Circular Economy: Case Studies and a Roadmap," examines the circular economy experiences of companies operating across different sectors in Türkiye, drawing on findings obtained directly from the field.

The report explores the motivations driving companies towards transformation, the practices they have implemented, the challenges they have encountered, and the support mechanisms they need. It presents concrete examples and outcomes under the themes of energy, water, raw materials, waste management, and digitalisation.

The DÖNGÜSEL Model developed in the report provides an eight-step roadmap to guide companies in assessing their current status, identifying priorities, improving their measurement and monitoring infrastructure, and scaling up successful practices.

Drawing on the experiences of companies, this report serves as a comprehensive reference for businesses, public institutions, academia, financial institutions, and all relevant stakeholders seeking to better understand the transition to a circular economy and develop actionable steps towards its implementation.