

Darío Benito Bentué

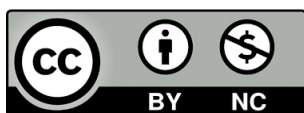
Desarrollo avanzado para la medición integrada y el reporting de la economía circular en el sector financiero desde un enfoque teórico

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Tesis Doctoral

DESARROLLO AVANZADO PARA LA MEDICIÓN
INTEGRADA Y EL REPORTING DE LA ECONOMÍA
CIRCULAR EN EL SECTOR FINANCIERO DESDE
UN ENFOQUE TEÓRICO

Autor

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UNIVERSIDAD DE ZARAGOZA
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Han sido cuatro años de trabajo en lo académico, profesional y personal que sin lugar a duda hubiera sido imposible acometerlos sin todos vosotros. Por eso, antes de comenzar con una Tesis de la que todos habéis oído hablar, quiero guardar un hueco para agradecer todo lo que habéis hecho por mí. Sin lugar a duda, vosotros habéis sido la motivación no solo para estos cuatro años sino para todo el proceso que me ha llevado hasta el día de hoy.

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Resumen de la Tesis doctoral

La creciente crisis climática, junto con los desafíos derivados de la escasez de recursos agravados por patrones de consumo insostenibles, han planteado la necesidad de transitar hacia un modelo de economía circular (EC) a nivel mundial. Una EC implica la transformación de un modelo económico lineal en uno circular para reducir la dependencia de las materias primas y la energía, y para mitigar el impacto ambiental de la producción y el consumo. La EC se ha propuesto como una alternativa al modelo lineal basado en la extracción, producción, uso y desecho, para adaptar los modelos actuales a una economía con cero emisiones y residuos. Este modelo, que consiste en cerrar los ciclos de materiales, es aplicable tanto a nivel macroeconómico como en las empresas y organizaciones que cada vez más están incorporando principios de economía circular en su producción y prestación de servicios.

Debido a los beneficios y oportunidades que plantea la adaptación a la EC, la Unión Europea (UE) comunicó su Plan de Acción para financiar el crecimiento sostenible (Comisión Europea, 2018), donde establece la estrategia para el crecimiento de la financiación e inversión sostenible, la integración de los riesgos y oportunidades climáticos y medioambientales en las decisiones financieras, la transparencia y la divulgación de información y el desarrollo de productos financieros sostenibles. El marco regulatorio europeo, especialmente a través del Reglamento (UE) 2020/852 sobre la taxonomía europea de inversiones sostenibles, representa un punto de inflexión al establecer un sistema de clasificación unificado para inversiones que promueven la sostenibilidad ambiental. Dicho reglamento busca no solo reorientar los flujos de capital hacia actividades sostenibles, sino también promover una mayor transparencia en la divulgación de información ambiental y social por parte de las entidades financieras. De este modo, la UE pretende reorientar los flujos de capital hacia actividades e inversiones sostenibles y en las que participe directamente el sector financiero. De hecho, el sector financiero tiene un papel fundamental a la hora de facilitar la transición hacia una EC proporcionando financiación a los proyectos de EC y a las empresas proactivas. En particular, la EC caracterizada por la minimización de

residuos y la prolongación del ciclo de vida de los productos, emerge como un modelo esencial en la estrategia europea hacia una sostenibilidad efectiva y práctica.

Por ello, requiere al sector financiero medir y divulgar información acerca de inversiones que promuevan la sostenibilidad, entre las que se encuentra la EC. Asimismo, se deben divulgar las inversiones en actividades que permitan desarrollar nuevos modelos de negocio basados en servicios o en el uso compartido de bienes para mantener y maximizar la utilidad y valor de los productos el mayor tiempo posible. Estos avances hacia la EC requieren no sólo de las fuerzas institucionales y del mercado, sino también de la adaptación en todos los sectores, incluido el financiero. Esta necesidad de adaptación en los productos financieros es la que ha llevado a la Unión Europea (UE) a considerar al sector financiero como un actor clave para favorecer el funcionamiento sostenible de la economía y la promoción de la EC. Sin embargo, el análisis del papel de las entidades financieras en la promoción de la EC es un tema reciente en la literatura.

No obstante, la investigación sobre las prácticas del sector financiero en medición y *reporting* de EC se encuentra en una fase incipiente, lo que justifica algunos de los principales objetivos de esta Tesis doctoral, que plantea desarrollar nuevos conocimientos en la medición integrada y el desarrollo de prácticas de *accountability* desde un enfoque teórico específicamente aplicado a la EC en el sector financiero. La investigación realizada responde a una brecha en la literatura relacionada con la adopción de principios de EC en el sector financiero, la evaluación del impacto de los instrumentos financieros tradicionales en la transición hacia modelos circulares y la implementación de la Taxonomía europea de inversiones sostenibles en la divulgación. La investigación realizada radica en la creciente necesidad de transformar modelos de inversión y financiación hacia prácticas circulares, alineadas con la normativa europea y las exigencias del mercado. A través de un análisis exhaustivo, se busca comprender cómo los instrumentos financieros existentes pueden facilitar la transición hacia la EC, identificando los principales desafíos en el *reporting* de sostenibilidad y evaluando el papel del sector financiero en la promoción de la EC.

A pesar del creciente interés en la sostenibilidad dentro del sector financiero, existen *gaps* en la literatura sobre la incorporación de los principios de la EC en el sector financiero, específicamente en el uso de instrumentos como el *leasing* y el *renting* para fomentar modelos circulares; el impacto del sector financiero en la transición hacia la EC, con escasa evidencia empírica sobre cómo los instrumentos financieros pueden promocionar la EC; el nivel de adopción y aplicación de la Taxonomía europea de inversiones sostenibles, específicamente en la medición y *reporting* de impactos medioambientales y sociales y en la incorporación de dichos criterios en las decisiones financieras; y la priorización y medición de recursos financieros para inversiones sostenibles, especialmente en tecnologías de energía sostenible donde la financiación sostenible, la financiación pública y la inversión privada son aspectos poco explorados en la literatura. La contribución del sector financiero a la EC puede ir más allá de las iniciativas adoptadas dentro de sus instalaciones y la financiación de proyectos de EC. En concreto, algunos instrumentos financieros ofrecidos por el sector, como los contratos de leasing y renting, pueden estar relacionados con mejoras indirectas en áreas como las emisiones de carbono, la eficiencia energética y las energías renovables. Los resultados muestran que las entidades del sector financiero presentan diferencias significativas en la información que reportan sobre EC, lo que dificulta la comparabilidad y la evaluación de impactos. Se evidencia que la incorporación gradual de la EC mediante el uso de instrumentos financieros tradicionales adaptados a este contexto como es a través de los contratos de *renting*, pueden contribuir a la optimización del uso de recursos y reducción de emisiones, siendo un instrumento financiero tradicional que promueve modelos circulares al fomentar la servitización, reduce la necesidad de propiedad privada, optimiza el uso de los activos y, consecuentemente, contribuye a reducir las emisiones de carbono y mejorar la eficiencia energética. El grado bajo de alineación con la Taxonomía de la UE evidencia que el sector financiero se enfrenta a dificultades a la hora de aplicar la regulación con motivo de la falta de metodologías estandarizadas, lo que dificulta la transparencia en el *reporting* de impactos en el sector.

No obstante, analizando la priorización y medición de recursos financieros para inversiones sostenibles, se demuestra la importancia del entorno institucional en la

financiación de tecnologías sostenibles para lograr una transición energética real hacia un escenario de cero emisiones, lo que hace necesaria la regulación y los marcos institucionales por su papel clave en la movilización de recursos financieros hacia inversiones sostenibles. Por último, los resultados identifican métricas e indicadores clave para el *reporting* de EC, mejorando la medición de los impactos ambientales y sociales de las inversiones.

En definitiva, esta Tesis doctoral aporta evidencia empírica sobre la integración de la EC en el sector financiero, resaltando el papel clave de los instrumentos financieros tradicionales, la necesidad de mejorar la transparencia en la divulgación de información a través de métricas específicas que permitan evaluar la EC e informar de manera transparente a los *stakeholders* sobre la EC, estableciendo bases claras para el reporte dentro del marco de la contabilidad medioambiental y la importancia de crear marcos regulatorios sólidos para incentivar y priorizar los recursos financieros hacia las inversiones en EC. Para ello, profundiza en el análisis del papel del sector financiero en la promoción efectiva de la EC y la sostenibilidad, examinando específicamente cómo instrumentos financieros tradicionales y emergentes están siendo adaptados para enfrentar estos retos contemporáneos. Los resultados obtenidos tienen implicaciones tanto para el ámbito académico como para el sector financiero y los responsables políticos, proporcionando una base para futuras investigaciones en EC y contabilidad medioambiental.

1.Capítulo primero. Introducción

1.1 Introducción

La creciente crisis climática, junto con los desafíos derivados de la escasez de recursos agravados por patrones de consumo insostenibles, han planteado la necesidad de transitar hacia un modelo de economía circular (EC) (Barros et al., 2021; Nuca, 2020; Yang et al., 2023).

La EC se plantea como alternativa al modelo lineal tradicional de "producir, usar y tirar", permitiendo reemplazarlo por ecosistemas industriales basados en la reutilización, restauración y renovación de materiales, y en la energía en ciclos cerrados (Ellen MacArthur Foundation, 2015; Frosch & Gallopoulos, 1989; Korhonen et al., 2018). Además, la EC permite desarrollar modelos de negocio sostenibles (Jun and Xiang, 2011; Kirchherr et al., 2017; Stahel, 2016; Tisserant et al., 2017) excluyendo residuos de los procesos y maximizando el valor del producto durante el mayor tiempo posible (Stahel, 2016). Por ello, la EC favorece la competitividad de las empresas (Lewandowski, 2016), originando beneficios y oportunidades sobre los costes operativos, la rentabilidad financiera, el impacto medioambiental y la percepción respecto a los *stakeholders* (Ormazabal et al., 2018).

Debido a los beneficios y oportunidades que plantea la adaptación a la EC, la Unión Europea (UE) comunicó su Plan de Acción para financiar el crecimiento sostenible (Comisión Europea, 2018) donde establece la estrategia para el crecimiento de la financiación e inversión sostenible, la integración de los riesgos y oportunidades climáticos y medioambientales en las decisiones financieras, la transparencia y la divulgación de información y el desarrollo de productos financieros sostenibles. En este contexto, el sector financiero tiene un papel clave en la financiación e inversión de empresas y proyectos que promuevan prácticas circulares (Bowman, 2010; Ozili and Opene, 2021; Zhelyazkova, 2021). El sector financiero es un componente fundamental de la economía que engloba todas aquellas instituciones, mercados y mecanismos encargados de la intermediación y gestión de recursos monetarios, siendo su función principal la de canalizar el ahorro hacia la inversión, facilitando el acceso al crédito y optimizando la asignación de capital en la economía. Para conseguir la integración de las finanzas sostenibles y alcanzar la necesaria transformación del sector financiero, la

UE busca reorientar los flujos de capital hacia actividades e inversiones sostenibles. Por ello, requiere que el sector financiero mida y divulgue información acerca de inversiones que promueven la sostenibilidad, entre las que se encuentra la EC (Cosma et al., 2020; Malecki, 2022).

Con el objetivo de dotar al sector financiero de las herramientas necesarias para medir y divulgar sobre inversiones sostenibles, la UE publicó el Reglamento (UE) 2020/852¹ del Parlamento Europeo del Consejo de 18 de junio de 2020 denominado “Taxonomía europea de inversiones sostenibles”, que incorpora la clasificación de actividades que se consideran ambientalmente sostenibles, entre las que se encuentran aquellas que fomentan y estimulan el desarrollo de modelos de negocio circulares. No obstante, aunque son las entidades financieras las que tienen el imperativo de medir y divulgar información acerca de las inversiones en actividades económicas que contribuyan a la sostenibilidad (Aranda-Usón et al., 2020; Marín-Vinuesa et al., 2023), la divulgación del sector financiero sobre EC y su inclusión en los informes se encuentra en una fase incipiente ante la necesidad de adaptación a las nuevas exigencias en materia de transparencia y rendición de cuentas, lo que implica tener que desarrollar nuevos sistemas de medición y *reporting* para evaluar su impacto ambiental y económico (Di Vaio et al., 2023). Por lo anterior, uno de los principales objetivos de esta Tesis doctoral es la medición integrada y el desarrollo de prácticas de *accountability* desde un enfoque teórico específicamente aplicado a la EC en el sector financiero.

Por otro lado, el incremento de valor que los *stakeholders* perciben en las actividades sostenibles, junto a la demanda por parte de las instituciones y reguladores para que el sector financiero se adapte a las finanzas sostenibles, ha provocado un aumento de la presión sobre el sector financiero con el objetivo de adoptar prácticas de mayor divulgación relacionadas con la sostenibilidad (Aguado-Correa et al., 2023; Elalfy and Weber, 2019; Pérez-Ruiz and Rodríguez- del Bosque, 2012). Debido a que se trata de un tema poco estudiado en ámbito académico, se hace necesario el análisis y desarrollo de

¹ El Parlamento Europeo y el Consejo de la Unión Europea. (2020). REGLAMENTO (UE) 2020/852 del Parlamento Europeo y del Consejo de 18 de junio de 2020 relativo al establecimiento de un marco para facilitar las inversiones sostenibles y por el que se modifica el Reglamento (UE) 2019/2088. <https://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32020R0852>

nuevas métricas e indicadores específicas de EC que reflejen los impactos y beneficios de estas prácticas circulares en el sector (Dewick et al., 2020; Gunarathne et al., 2021). Por este motivo, en esta investigación se amplía el conocimiento sobre instrumentos financieros aplicados a los principios de EC y acerca de cómo las entidades financieras pueden reportar los avances en el cierre de círculos de materiales a través de métricas integradas de EC en respuesta a la presión de sus *stakeholders*.

En este contexto, la normativa europea en materia de sostenibilidad se encuentra en continuo desarrollo con el objetivo de mejorar la transparencia en la rendición de cuentas y la sostenibilidad de las organizaciones (Ahlström and Monciardini, 2022).

Para ello, la UE desarrolló un marco regulatorio de mejora de la transparencia e integración de la sostenibilidad en el sector financiero y empresarial. La Directiva 2014/95/UE del Parlamento Europeo y del Consejo, de 22 de octubre de 2014 (NFDR, por sus siglas en inglés), estableció la obligación para grandes empresas de interés público con más de 500 empleados de divulgar información no financiera sobre aspectos medioambientales, sociales, de derechos humanos, y sobre la lucha contra la corrupción y el soborno. Su aplicación evidenció la falta de uniformidad y comparabilidad en la divulgación de información de los bancos europeos (Aguado-Correa et al., 2023; Cosma et al., 2020; Ibáñez Jiménez, 2021).

Paralelamente, en el ámbito financiero, la Directiva 2014/65/UE del Parlamento Europeo y del Consejo, de 15 de mayo de 2014, conocida como MiFID II y complementada con el Reglamento Delegado (UE) 2017/565 de la Comisión, de 25 de abril de 2016, buscó mejorar la transparencia, la protección de los inversores y la supervisión de los mercados financieros y sentó las bases para integrar aspectos Ambientales, Sociales y de Gobernanza (ASG) en el servicio de inversión y asesoramiento. Posteriormente, el Reglamento (UE) 2019/2088, conocido como el Reglamento de Divulgación de Finanzas Sostenibles (SFDR, por sus siglas en inglés), estableció un marco integral para la divulgación de información sobre sostenibilidad en el sector financiero, definiendo criterios para clasificar productos financieros como sostenibles.

Para determinar qué se considera una inversión sostenible, la UE publicó el Reglamento Delegado (UE) 2020/852, conocido como el Reglamento de la Taxonomía europea de inversiones sostenibles, facilitando la clasificación de actividades económicas sostenibles con el objetivo de avanzar en el crecimiento de la inversión sostenible según el Plan de Acción de la UE sobre finanzas sostenibles. Además de ser una herramienta para el sector, la normativa establece que las empresas y el sector financiero divulguen información sobre cómo y en qué medida sus actividades se alinean con los criterios de sostenibilidad definidos en la taxonomía de la UE. Complementariamente, el Reglamento Delegado (UE) 2021/1253 de la Comisión, de 21 de abril de 2021, conocido como MiFID II Green, modificó la Directiva MiFID II al incorporar factores ASG en el asesoramiento financiero y la gestión de carteras, obligando a considerar la sostenibilidad en la toma de decisiones de inversión.

Por último, la Directiva (UE) 2022/2464 de 14 de diciembre de 2022, conocida como la Directiva sobre la presentación de información corporativa en materia de sostenibilidad (CSRD, por sus siglas en inglés), amplió el alcance de la Directiva NFRD con el objetivo de mejorar la calidad, coherencia y comparabilidad de la información sobre sostenibilidad que deben divulgar las empresas.

En definitiva, el Reglamento MiFID II *Green*, el Reglamento SFDR y el Reglamento de la Taxonomía europea de inversiones sostenibles han impulsado la incorporación de la sostenibilidad en el marco regulatorio del sector financiero de manera integral. Mientras MiFID II regula cómo se debe integrar la sostenibilidad en el análisis de riesgos de una inversión y analizar las preferencias sobre sostenibilidad de los clientes, SFDR asegura la transparencia en el mercado sobre cómo se integra la sostenibilidad en las actividades. Este enfoque, combinado con el Reglamento de Taxonomía, tiene como objetivo mejorar la protección de los inversores, promover la inversión sostenible y fortalecer la integridad y estabilidad de los mercados financieros de la UE en materia de sostenibilidad.

Este avance en la estrategia sostenible europea ha impulsado el desarrollo normativo en materia de sostenibilidad situándolo en el debate regulatorio (Ahlström and Monciardini, 2022). Como resultado, el marco legislativo está siendo enriquecido por

responsables políticos y reguladores (Bruno and Lagasio, 2021) con el fin de fomentar la integración de prácticas sostenibles en el sector financiero, tanto en sus operaciones y reportes (Joseph, 2012), previniendo de esta manera el *greenwashing* (de Freitas Netto et al., 2020). No obstante, la literatura requiere de una mayor profundización en la medición y divulgación de impactos ambientales y sociales (Bengo et al., 2022). Por ello, esta Tesis busca examinar hasta qué punto el sector financiero mide y divulga los impactos de sus inversiones sostenibles, así como los avances específicos para redirigir los flujos de capital hacia las inversiones sostenibles, alineándose con las expectativas de los *stakeholders* en términos de transparencia y *reporting*.

En definitiva, el principal objetivo de esta Tesis doctoral es avanzar en el conocimiento sobre la medición integrada y el *reporting* de la EC en el sector financiero, así como ampliar la investigación en la financiación de inversiones en EC y su divulgación desde un enfoque teórico. A tal fin, se da respuesta a un *gap* en la literatura en el análisis de hasta qué punto la EC está siendo integrada en la actividad de las entidades financieras y cómo se instrumenta la respuesta a los *stakeholders* en el marco de la normativa de divulgación en materia de financiación e inversión sostenible en la UE. Para alcanzar el objetivo principal de la Tesis, se han desarrollado objetivos específicos de investigación en el marco de las principales teorías en el área de conocimiento de economía financiera y contabilidad que se detallan en los siguientes apartados de este capítulo. Más concretamente, en el apartado 2 se analiza la literatura en la que se basa la Tesis doctoral, mientras que en el tercer apartado se identifican los principales *gaps* de investigación que motivan esta Tesis. Por último, en el apartado 4 se describe la estructura completa de la Tesis, incluyendo los aspectos principales de cada capítulo.

1.2 Planteamiento de la Tesis y enfoque teórico

1.2.1 Delimitación del ámbito de análisis: Economía circular y sostenibilidad en el sector financiero

La EC se plantea como potenciadora de la extensión de la vida útil de los productos, la economía de desempeño y la reducción de residuos (Jun and Xiang, 2011; Kirchherr et al., 2017; Stahel, 2016; Tisserant et al., 2017). Por ello, genera una ventaja competitiva en aquellas empresas que consiguen mantener el valor del producto durante el mayor tiempo posible, excluyendo residuos de los procesos productivos y maximizando el valor del producto en cada punto del ciclo de vida (Roos, 2014; Salvioni and Brondoni, 2020; Stahel, 2016). El sector financiero tiene el potencial para ser un actor clave en la financiación de modelos circulares que permitan la transformación de las empresas (Ellen McArthur Foundation, 2015; European Commission, 2019), originando oportunidades a través de la demanda de nuevos productos financieros, la necesidad de financiación de proyectos circulares y el aumento de la base de clientes y de cuota de mercado (Aranda-Usón et al., 2019; Moneva et al., 2023; Zhelyazkova, 2021). Además, a través de sus prácticas de préstamos y de inversión, puede influir en las empresas a través de las condiciones asociadas a sus servicios financieros, consiguiendo que estas prácticas circulares se extiendan a todos los sectores (Aranda-Usón et al., 2019; Ozili and Opene, 2021; Ziolo et al., 2020). Un ejemplo de ello es el arrendamiento financiero, entre los que se encuentra el *leasing* o el *renting*, como herramientas financieras de las entidades del sector financiero para superar las barreras económicas y financieras relacionadas con la inversión en EC y fomentar la servitización sobre la propiedad. Aun así, en el ámbito de investigación, son pocos los autores que han profundizado explícitamente en la medición de la EC y los impactos relativos en entidades del sector financiero, por lo que el análisis del *reporting* de la EC a nivel sectorial se encuentra en plena evolución (Moneva et al., 2023).

En la siguiente Figura se ilustra el ámbito de análisis sobre el papel del sector financiero en la financiación de la EC. Este sector, a través de su actividad, canaliza ahorros y los invierte en productos y servicios. Debido a su actividad, se identifica como impulsor de la EC. El sector financiero es un actor clave al proporcionar recursos económicos y estrategias de inversión necesarias para fomentar proyectos circulares. Su

participación es crucial para la financiación de modelos de negocio circulares y promover la EC.

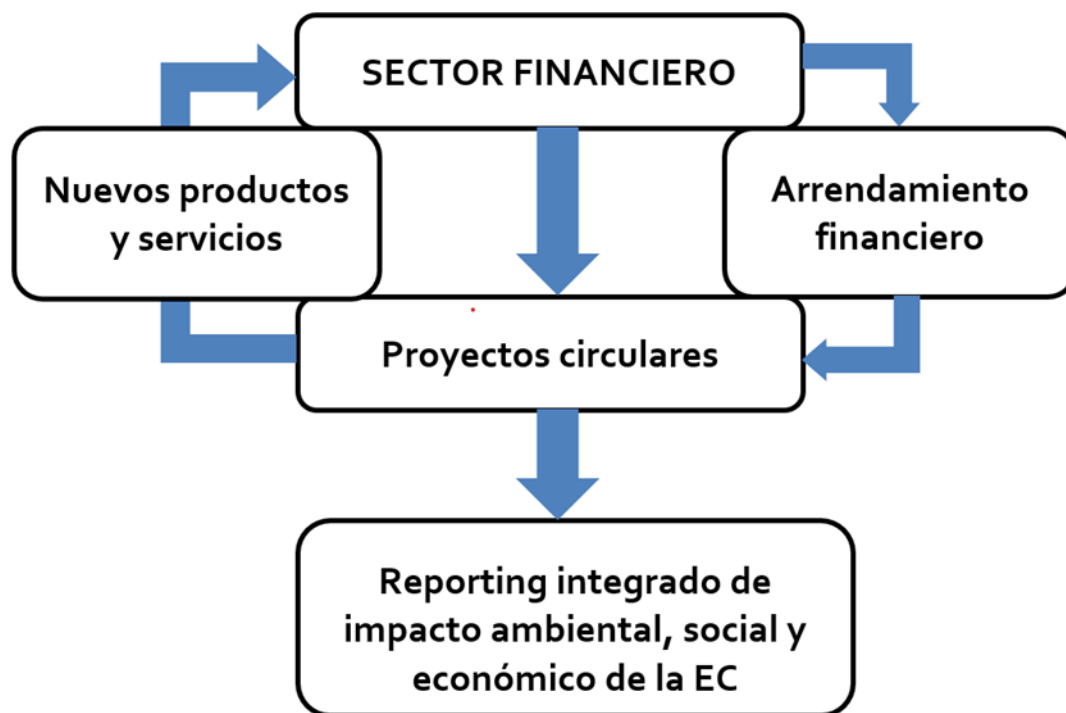


Figura 1 Ámbito de análisis de la Tesis

Como parte de la necesidad de adaptación a la EC, el sector financiero necesita desarrollar y ofrecer productos y servicios que faciliten el acceso a financiación y potencien la EC a través de instrumentos financieros que impacten positivamente. Estos pueden incluir los fondos de inversión o mecanismos de financiación basados en el uso eficiente de los recursos como es el arrendamiento financiero. La financiación a través de esquemas de arrendamiento permite a las empresas y consumidores adquirir bienes sin la necesidad de la propiedad, lo que podría promover el uso eficiente de los recursos. En la EC, esto se traduciría en modelos basados en el “producto como servicio” donde los bienes son reutilizados, reparados o reciclados al final de su ciclo de vida. Todo ello da lugar a la financiación de proyectos circulares que optimizan el uso de los recursos y reducen la generación de residuos, generando valor, no solo desde el punto de vista económico, sino también en términos ambientales y sociales. Por último, el modelo propuesto en la figura detalla la importancia del *repoting* integrado y la

contabilidad medioambiental como mecanismos para evaluar y divulgar los impactos de los proyectos circulares. De esta manera, a través de métricas o indicadores se podría medir el desempeño de la EC en el sector financiero y fomentar la transparencia en la toma de decisiones.

1.2.2 Divulgación de la sostenibilidad y *accountability* de economía circular en el sector financiero

La *accountability* en materia de sostenibilidad surgió en los años 90 como mecanismo para la rendición de cuentas, vinculándola a la contabilidad tradicional a través de la integración de la *triple-bottom-line* o, posteriormente, a partir de estándares como los de la *Global Reporting Initiative* (GRI) (Lamberton, 2005). Su integración ha sido esencial para abordar dificultades que la contabilidad tradicional afronta en materia de divulgación sostenible (Joseph, 2012). A pesar de ello, los actuales marcos de *accountability* en materia de sostenibilidad podrían ser inadecuados (Mohammed, 2013). Por ello, la integración de indicadores es clave para poder capturar impactos que permitan medir, gestionar y comunicar sobre la EC, permitiendo a los *stakeholders* tomar decisiones informadas y responsables, haciendo que la *accountability* sea crucial para cuantificar y gestionar el impacto de la EC (Di Vaio et al., 2023; Scarpellini, 2022).

No cabe duda de que el sector financiero tiene también que incorporar paulatinamente los principios de la EC en sus propias operaciones y en el futuro próximo, los bancos tendrán que informar acerca de los fondos para la EC y las decisiones de inversión a través de métricas específicas (Gunarathne et al., 2021). Estos objetivos pueden alcanzarse con entidades que propicien el retorno de inversiones sostenibles medioambientalmente, de planes de formación dirigidos al personal para el cumplimiento de la regulación en materia de EC, y que sus profesionales sepan valorar oportunamente las inversiones en EC, o instaurando prácticas internas sobre la base de los valores circulares como el reciclaje, la disminución de residuos o el planteamiento de otros usos de productos y materiales que alarguen su vida útil (Ozili & Opene, 2021).

También estas acciones internas requieren un esfuerzo de *accountability* por parte del sector financiero, al objeto de informar acerca de sus logros en la introducción de los principios circulares a través de información no financiera, que se tiene que contemplar

en los informes de sostenibilidad. Algunos autores han señalado que la divulgación no financiera en cuanto a impactos medioambientales es aún una práctica algo difusa en las entidades europeas y cabe esperar que la EC encuentre las mismas barreras (Dewick et al., 2020; Gunarathne et al., 2021) .

En la literatura, los autores que han analizado explícitamente los impactos de los bancos en la EC y la sostenibilidad con la información correspondiente son escasos (Bonifacio Neto and Branco, 2019). Estudios anteriores han explorado cómo los informes de sostenibilidad de las instituciones financieras incorporan consideraciones ambientales y sociales en sus sistemas de gestión de riesgos, o han analizado los informes de sostenibilidad de los bancos y sus vínculos con los valores de la RSC (Chang et al., 2019; De La Cuesta-González et al., 2006). No hay duda de que el sector financiero puede contribuir sustancialmente al desarrollo sostenible (Bonifacio Neto and Branco, 2019; Jayabal and Soundarya, 2016), y el *reporting* puede conllevar para los bancos y otras instituciones financieras un incremento de sus acciones para la sostenibilidad (Joseph, 2012).

1.2.3 La Teoría de Stakeholders, economía circular en el sector financiero y enfoque teórico de la Tesis

La Teoría de los *Stakeholders*, desarrollada por Freeman (1984), sostiene que la maximización del valor a largo plazo no debe centrarse exclusivamente en los accionistas, sino también en todos los grupos de interés afectados por las actividades de una empresa. Esto se ha convertido en un elemento central para las prácticas de reporte de sostenibilidad (Diwan and Amarayil Sreeraman, 2024). Las empresas tienen responsabilidades no solo ante sus accionistas, sino también hacia sus empleados, clientes, proveedores, gobiernos e instituciones, entre otros (Qureshi et al., 2020). Esta teoría ha sido crucial para impulsar la transición de los modelos de negocio tradicionales a modelos de negocio circulares (Salvioni and Brondoni, 2020), destacando el papel clave de los *stakeholders* en la creación de valor y en la implementación de la EC (Kujala et al., 2023; Yetunde Adenike Adebayo et al., 2024).

La presión de los *stakeholders* para que las empresas mejoren su desempeño ambiental (Deegan, 2006; Góes et al., 2023), ha posicionado a los modelos de negocio circulares

como una solución al modelo lineal tradicional de “producir, usar y tirar” (Barros et al., 2021). La EC no solo representa un enfoque sostenible, sino que también presenta oportunidades y beneficios en términos de rentabilidad, reducción de costes y mejora del prestigio de las empresas frente a sus *stakeholders* (Aranda-Usón et al., 2019; Ormazabal et al., 2018; Ozili and Opene, 2021).

La transición hacia modelos circulares requiere financiación para proyectos sostenibles, posicionando al sector financiero como un actor clave en la transferencia de flujos de capital hacia estas actividades (Kumar et al., 2024; Ormazabal et al., 2018). Este sector tiene una influencia directa sobre la disponibilidad de capital para proyectos circulares, lo que le obliga a responder a las demandas de transparencia y sostenibilidad de los *stakeholders* (Mebar, 2024). En este contexto, los *stakeholders* del sector financiero desempeñan un papel crucial en la promoción de prácticas circulares y en la transparencia sobre las actividades de las instituciones financieras, alineándose con expectativas sociales y ambientales (Elalfy and Weber, 2019; Thi Thanh Binh and Bao Chi, 2024). De esta manera, la presión de los *stakeholders* garantiza que se cumpla con las expectativas en materia de sostenibilidad, actuando como incentivo para divulgar información sostenible (Diwan and Amarayil Sreeraman, 2024).

Los bancos que implementan prácticas sostenibles orientadas a la transparencia logran reducir las asimetrías de información, fortaleciendo la confianza de los *stakeholders* en sus operaciones (Cazacu, 2024). Además, los *stakeholders* promueven la adopción de principios de la EC en el sector financiero y exigen información clara sobre sostenibilidad (Moneva et al., 2023). Esta presión ha llevado a que la divulgación de información no financiera sea clave para cumplir con las expectativas de los *stakeholders*, ayudándoles a evaluar el desempeño social y ambiental de las instituciones financieras (Aguado-Correa et al., 2023; Dmuchowski et al., 2023).

Aunque la Teoría de los *Stakeholders* ha sido determinante para fomentar la sostenibilidad, su aplicación dentro del marco de la EC sigue siendo estudiada (Salesa et al., 2022). Una de las principales brechas identificadas radica en la falta de transparencia en los informes sobre cómo las prácticas financieras apoyan definitivamente la EC, lo que dificulta medir su impacto real en la promoción de un

modelo económico más sostenible (Janik et al., 2020). Esta opacidad no solo afecta a la percepción de los *stakeholders* sobre el compromiso sostenible del sector financiero, sino que también impide un análisis adecuado de la eficacia de las prácticas financieras circulares (Di Vaio et al., 2023; Ozili and Opene, 2021).

Además, los informes relacionados con la EC en el sector financiero presentan desafíos de legibilidad, lo que dificulta la comprensión por parte de los *stakeholders* (Keskin and Esen, 2024). No obstante, la divulgación de información sobre sostenibilidad demandada por los *stakeholders* tiene un impacto positivo en el valor de las empresas (Qureshi et al., 2020). Esto resalta la necesidad de mejorar los estándares de reporte en materia de sostenibilidad, especialmente frente a las crecientes presiones coercitivas de reguladores e instituciones, que buscan influir en las prácticas de reporte a través de leyes y regulaciones diseñadas para influir en el comportamiento de las empresas buscando que divulguen información sobre temas relacionados con la sostenibilidad (Farooq and Maroun, 2001; Wagenhofer, 2024).

Algunos autores abordan la investigación contable en el marco de la EC desde perspectivas teóricas, como la teoría de recursos y capacidades (Llena-Macarulla et al., 2023) y su evolución al marco teórico de capacidades dinámicas (Scarpellini et al., 2020). Asimismo, Llena-Macarulla et al. (2023) aplican la Teoría Institucional para estudiar las prácticas de contabilidad ambiental relacionadas con la EC al considerar que la regulación podría explicar parcialmente la implementación de prácticas de medición y *reporting* de EC, en línea con Marco-Fondevila et al. (2020).

La Teoría Institucional permite interpretar los fenómenos de inversiones sostenibles, como por ejemplo los que se analizan en esta Tesis en el sector energético como caso de estudio, dado el papel esencial de los gobiernos en el cambio de las tecnologías y las pautas de consumo en la transición a una economía baja en emisiones (Andrews-Speed, 2016). Cumplir con la regulación otorga legitimidad a las organizaciones, asegurando el acceso a los recursos y su supervivencia (DiMaggio and Powell, 1983). El creciente debate voluntario/obligatorio apunta a que la Teoría Institucional podría describir el comportamiento de las instituciones financieras en el futuro próximo. Si la creciente tendencia a incluir factores ASG en las decisiones de inversión responde a la presión

institucional (Farooq and Maroun, 2001), el objetivo de proporcionar la información más útil y relevante a los grupos de interés puede estar en juego.

Ante las consideraciones anteriores, y teniendo en cuenta los tres tipos de isomorfismo que generan los cambios institucionales (DiMaggio and Powell, 1983), observamos que el isomorfismo coercitivo explica la transición a través de inversiones sostenibles, como la estudiada en esta Tesis, porque las presiones formales e informales son ejercidas por las instituciones sobre las organizaciones (Álvarez-Etxeberria et al., 2023). El isomorfismo coercitivo puede utilizarse con aquellos fabricantes que adoptan nuevas normas gubernamentales establecidas para combatir la contaminación.

Por lo tanto, existe cierta interacción entre los requisitos del entorno regulatorio (presión coercitiva) y la necesidad de diseñar sistemas para mantener la eficiencia y seguir siendo competitivos (Tsamenyi et al., 2006). Como la influencia institucional del desarrollo sostenible varía según la idiosincrasia de cada industria (Escobar and Vredenburg, 2011), la regulación del cambio climático, las políticas de energías renovables y los incentivos para la inversión social se consideran factores críticos para nuestro estudio en tecnologías sostenibles. Por ende, aunque el principal marco teórico aplicado en la Tesis es el de *Stakeholders*, también se aplica el marco de la Teoría Institucional, especialmente en el análisis específico de inversiones.

Desde la perspectiva teórica de *stakeholders*, la presión de los grupos de interés para que el sector financiero adopte un comportamiento sostenible y proporcione una representación adecuada de las prácticas de sostenibilidad ha dado lugar a que la divulgación no financiera asuma un papel crucial en el debate regulatorio europeo (Dmuchowski et al., 2023). El derecho de los *stakeholders* a tomar decisiones sobre la base de la información divulgada por las empresas es la base de un enfoque normativo (Deegan, 2009).

Sin embargo, la presión ejercida desde las instituciones, tanto directamente a nivel coercitivo, como indirectamente al fomentar isomorfismos miméticos, supone un fuerte estímulo al desarrollo de políticas de medición y divulgación de impacto sobre EC por parte de las organizaciones (Álvarez-Etxeberria et al., 2023). En consecuencia, ambos enfoques teóricos serán los predominantes en esta Tesis.

1.3 Objetivos de la investigación y estructura de la Tesis

A partir del análisis de la literatura y del marco teórico, y habida cuenta el principal objetivo de esta Tesis doctoral que es avanzar en el conocimiento para la medición integrada y el *reporting* en EC en el sector financiero, se desarrollan los objetivos específicos de investigación resumidos a continuación, vinculados a las correspondientes preguntas de investigación (tabla 1.1):

Obj 1) Ampliar el conocimiento sobre la introducción de los principios de la EC en el sector financiero y sus determinantes.	
Obj 1.1 RQ1.1	Conocer hasta qué punto las entidades financieras informan sobre la EC de cara a la Taxonomía europea de inversiones sostenibles. ¿En qué medida las entidades del sector bancario informan sobre la EC en el contexto de la Taxonomía europea de inversiones sostenibles?
Obj 1.2 RQ1.2	Análisis de la relación entre el <i>renting</i> y el modelo circular en el sector financiero en el marco de la EC. ¿Cómo pueden instrumentos financieros existentes como el <i>renting</i>, contribuir al desarrollo de modelos circulares dentro del sector financiero?
Obj 2) Analizar el potencial de los instrumentos de financiación existentes para extender el modelo circular en el marco de la contabilidad medioambiental.	
Obj 2.1 RQ2.1	Analizar el cambio en los contratos de arrendamiento financiero con relación al modelo de EC. ¿Está el cambio hacia contratos de <i>leasing/renting</i> positivamente relacionado con el modelo de EC?

Obj 2.2 RQ2.2	Definición y medición de indicadores específicos para dimensionar e informar sobre el impacto del <i>renting</i> en términos de EC para el sector financiero. ¿Qué indicadores podrían utilizarse para informar sobre el impacto de los contratos de <i>leasing/renting</i> como contratos relacionados con la EC?
Obj 3) Análisis del nivel de adopción de la Taxonomía europea de inversiones sostenibles y sus determinantes en el sector financiero para la divulgación de impactos.	
Obj 3.1 RQ3.1	Definición y análisis de los principales indicadores de impactos del sector. ¿Cuáles son los indicadores más utilizados por el mercado para reportar las principales incidencias adversas (PAIs)?
Obj 3.2 RQ3.2	Análisis del nivel de introducción de la Taxonomía europea de inversiones sostenibles en el <i>reporting</i> de impactos a nivel sectorial. ¿Los fondos están reportando alineación con la Taxonomía europea de inversiones sostenibles de la UE?
Obj 4) Definición, medición y priorización de recursos financieros para inversiones sostenibles en tecnologías <i>Power-to-Gas</i> y el <i>reporting</i> de sus impactos sociales.	
Obj 4.1 RQ4.1	Analizar en qué medida el entorno institucional influye en la movilización de recursos financieros para inversiones <i>Power-to-Gas</i>. ¿Hasta qué punto el entorno institucional influye en la movilización y organización de los recursos financieros para las inversiones en tecnologías <i>Power-to-Gas</i>?
Obj 4.2 RQ4.2	Investigar cómo se están priorizando los recursos del sector financiero para las inversiones en <i>Power-to-Gas</i>.

	¿Cómo se priorizan los recursos financieros para las tecnologías <i>Power-to-Gas</i> ?
Obj 4.3 RQ4.3	Definir cuáles son los indicadores de impacto social relacionados con inversiones <i>Power-to-Gas</i> y cómo facilitar el <i>reporting</i> de información. ¿Cómo pueden medirse los indicadores de impacto social relacionados con las inversiones en tecnologías de <i>Power-to-Gas</i> para su reporte?

Tabla 1.1. Objetivos específicos de la Tesis y principales preguntas de investigación

Al objeto de alcanzar la finalidad general de esta Tesis Doctoral, ésta se estructura en 5 capítulos que se resumen brevemente a continuación.

El capítulo 1 de introducción, expone las motivaciones que han dado origen a esta Tesis Doctoral, el *gap* en la literatura, el marco teórico y los objetivos que se pretenden alcanzar con la investigación realizada a través de la Tesis en su conjunto.

En el capítulo 2 se presenta el primer estudio que integra esta Tesis y que consiste en un análisis cualitativo de doble enfoque que permite profundizar en el conocimiento de la EC en el sector financiero. En primer lugar, se realiza un análisis cualitativo externo de la información no financiera de las 12 entidades del sector financiero español con mayor número de activos para analizar el nivel de divulgación sobre EC y su relación con un instrumento financiero tradicional como el *renting* de vehículos. En segundo lugar, se realiza un caso de estudio en una de las entidades a través de entrevistas semiestructuradas a profesionales del sector que permite analizar la percepción sobre la EC en las entidades y su promoción a través del *renting* de vehículos. Los resultados muestran la disparidad en la información divulgada por las entidades, el bajo nivel de relación entre la EC y las actividades que presentan características circulares, y la percepción del potencial del *renting* de vehículos como instrumento financiero tradicional que promueve la EC.

El capítulo 3 es el segundo estudio de la Tesis y aborda el papel del sector financiero en la promoción de la EC a través de productos específicos como el arrendamiento financiero. Identifica un *gap* académico respecto a cómo los instrumentos financieros tradicionales, en particular los contratos de *renting*, contribuyen a la transición hacia

modelos circulares. El estudio se basa en un enfoque de estudio de caso, analizando datos de contratos de *renting* en una entidad bancaria española durante un periodo de 18 años. El objetivo es evaluar el impacto del *renting* en la EC mediante el desarrollo de métricas que permiten medir los impactos en términos de eficiencia de recursos y reducción de emisiones. Las conclusiones del estudio evidencian que los contratos de *renting* favorecen la EC al reducir la necesidad de la propiedad, optimizar el uso del vehículo y extender su ciclo de vida. Asimismo, se identifica una tendencia creciente en la contratación de este instrumento financiero dentro del sector, permitiendo el acceso a tecnologías más limpias y mejorando la eficiencia de los recursos. Además, el capítulo vincula la contabilidad medioambiental con la necesidad de definir nuevas métricas que permitan al sector financiero reportar sus impactos sobre la EC. Por último, explora la percepción del sector financiero sobre su papel en la promoción de la EC.

En el capítulo 4 se plantean los resultados obtenidos a través del tercer estudio que integra esta Tesis, y analiza cómo se está integrando la sostenibilidad en las inversiones en el sector financiero a través del cumplimiento de la normativa europea en materia de sostenibilidad para las inversiones. Este estudio analiza cómo el sector financiero está incorporando criterios de sostenibilidad en sus decisiones de inversión e informa de sus impactos, aumentando así la transparencia tras la aplicación de la regulación. Se lleva a cabo un enfoque cuantitativo de análisis de datos extraídos entre diciembre de 2023 y marzo de 2024 de los 20 gestores de fondos más grandes del mundo, con el objetivo de analizar cómo se reportan impactos y el grado de adaptación a la normativa a través de la alineación de los fondos con la Taxonomía europea de inversiones sostenibles. Los resultados muestran el bajo grado de avance del sector en la alineación con la taxonomía de la UE, la dificultad en la aplicación de la regulación para la medición de impactos debido a la falta de metodologías estandarizadas y la preferencia en reportar indicadores sociales frente a indicadores medioambientales.

En el capítulo 5, que se corresponde con el cuarto estudio, se presentan los resultados planteados para la definición, medición y priorización de recursos financieros para inversiones sostenibles y el *reporting* de impactos sociales de las inversiones en entornos de sostenibilidad y EC. El estudio se centra en el análisis del impacto del entorno institucional en la movilización y organización de recursos financieros, en cómo

se priorizan estos recursos financieros para canalizarlos hacia inversiones sostenibles y explora indicadores de impacto social y su reporte en términos de divulgación sobre sostenibilidad. Se realiza un caso de estudio aplicado a inversiones de tecnologías energéticas sostenibles en el marco de la Taxonomía europea de inversiones sostenibles para ampliar el conocimiento acerca de cómo medir los recursos financieros y su priorización para analizar el papel desempeñado por las entidades financieras. Los resultados muestran que el entorno institucional y la regulación tienen un papel clave en la financiación de tecnologías sostenibles. La inclusión de tecnologías energéticas sostenibles en la taxonomía de la UE y la priorización de recursos financieros públicos y privados, son factores determinantes para facilitar este tipo de inversiones. Además, los resultados permiten analizar indicadores como la creación de empleo verde, el desarrollo de comunidades locales o la reducción de desigualdades socioeconómicas, destacando la importancia de su uso en los criterios de inversión.

Finalmente, en el capítulo 6 se resumen las principales aportaciones de la Tesis en el área de economía financiera y contabilidad y se presentan las conclusiones obtenidas del conjunto de la investigación y sus posibles aplicaciones de ámbito científico, gubernamental y profesional para el sector financiero, permitiendo proponer nuevas líneas de investigación futuras.

1.3.1 Enfoque metodológico

El primer estudio de esta Tesis tiene como objetivo ampliar el conocimiento sobre la introducción de los principios de la EC en el sector financiero, identificando sus determinantes y examinando el nivel de divulgación de información relacionada con la EC en el marco de la Taxonomía europea de inversiones sostenibles. Asimismo, se analiza cómo los instrumentos financieros existentes, como el *renting*, pueden contribuir al desarrollo de modelos circulares dentro del sector financiero.

Para abordar estos objetivos, se adoptó un enfoque metodológico cualitativo basado en el análisis de información no financiera reportada por entidades del sector financiero español. Se llevó a cabo un estudio de contenido de los informes de sostenibilidad e informes integrados de una muestra de 12 entidades financieras, seleccionadas a través de la base de datos SABI en el sector de actividades financieras y de seguros. La

selección de estas entidades se realizó considerando su representatividad en el mercado y la disponibilidad de información pública. El análisis se estructuró en dos niveles. En primer lugar, se evaluó la cobertura de indicadores clave de EC en los informes de sostenibilidad, verificando la alineación con los estándares de la *Global Reporting Initiative* (GRI). En segundo lugar, se llevó a cabo un análisis cualitativo de los términos y actividades específicas vinculadas a la EC, incluyendo el uso de instrumentos financieros como el *renting* en la promoción de modelos circulares.

El primer análisis se complementó con un estudio de caso centrado en una de las entidades de la muestra. Este caso permitió una exploración más detallada sobre la proactividad de la entidad hacia la EC. Se realizaron 10 entrevistas semiestructuradas con profesionales y directivos de diversas áreas funcionales. Las entrevistas incluyeron preguntas abiertas para obtener las perspectivas de los participantes, junto con preguntas estructuradas evaluadas mediante una escala tipo Likert. Estas entrevistas buscaron identificar la percepción de los entrevistados sobre la relación entre instrumentos financieros tradicionales como el *renting* y los modelos circulares.

Para finalizar, se analizaron los datos recopilados para identificar los niveles de divulgación de actividades relacionadas con la EC en los informes de sostenibilidad y evaluar cómo el *renting* podría ser un instrumento para fomentar modelos circulares en el sector financiero. Este enfoque metodológico combinó análisis de datos secundarios de los informes de sostenibilidad con datos primarios de las entrevistas, permitiendo obtener una visión integral de la implementación y percepción de la EC en el sector financiero español.

El segundo estudio se centró en analizar el potencial de los instrumentos financieros existentes, en particular los contratos de *leasing* y *renting*, para impulsar la EC dentro del marco de la contabilidad medioambiental. Se planteó la pregunta de investigación de si la transición hacia contratos de *renting* está positivamente relacionada con la EC y qué indicadores pueden utilizarse para medir el impacto de estos contratos. El análisis se basó en un estudio cuantitativo para examinar los datos históricos de contratos de *renting* para evaluar cómo contribuyen a la promoción de la EC. Para el estudio de caso, se seleccionó una entidad del sector financiero español con más de 5.000 empleados,

conocida por ofrecer contratos de *renting*. Esta entidad fue escogida debido a la disponibilidad de datos relevantes y su representatividad en el sector financiero en España.

En el análisis cuantitativo, se examinaron datos de un período de 18 años, desde 2004 hasta 2021, sobre variables clave de los contratos de *renting*, entre ellas: el kilometraje total, el horizonte temporal de los contratos, el tipo de cliente (individual o empresa), el modelo de vehículo, la clasificación ambiental, el valor residual de los vehículos al final de su vida útil y las inversiones realizadas. Estos datos permitieron evaluar la evolución de los contratos de *renting* y su impacto en la EC desde una perspectiva cuantitativa. Además, se aplicaron métodos de análisis estadístico para calcular promedios, ponderaciones y tendencias históricas en la evolución de los contratos de *renting* y su impacto en la EC. Se llevó a cabo un análisis específico de las emisiones de carbono y de la eficiencia energética, utilizando datos de fuentes como la Dirección General de Tráfico de España. Este análisis permitió comparar las características ambientales de los vehículos de *renting* con las de la flota nacional en general, evaluando el grado de eficiencia energética y reducción de emisiones logrados a través de este modelo de negocio.

Desde una perspectiva socioeconómica, el estudio evaluó cómo el *renting* fomenta un mayor uso de los vehículos por contrato y facilita el acceso a tecnologías más modernas y eficientes. En términos ambientales, se midió el impacto de estos contratos en la reducción de emisiones de carbono y la mejora de la eficiencia energética de flotas. Los resultados mostraron que los contratos de *renting* han contribuido significativamente a mejorar la sostenibilidad del parque automovilístico al permitir el acceso a vehículos menos contaminantes y fomentar un uso más intensivo y eficiente de los recursos.

El tercer estudio tuvo como propósito analizar el nivel de adopción de la Taxonomía europea de inversiones sostenibles en el sector financiero, identificando los principales indicadores utilizados por los gestores de fondos para reportar las principales incidencias adversas (PAIs) y evaluar el grado de alineación de los fondos con la taxonomía de la UE.

Para ello, se adoptó un enfoque metodológico cuantitativo basado en el análisis de datos reportados por los gestores de fondos de inversión. Se seleccionaron los 20 mayores gestores de fondos a nivel mundial según el total de activos gestionados en 2022, utilizando información del *Thinking Ahead Institute*. De esta selección, se analizaron 6.382 instrumentos financieros, excluyendo aquellos gestores que no divulgaron información a través de las *European ESG Templates* (EETs), el marco estandarizado de divulgación de criterios ambientales, sociales y de gobernanza (ASG).

Los datos analizados correspondieron al período entre diciembre de 2023 y marzo de 2024, garantizando información actualizada. Para el análisis se emplearon métodos de análisis cuantitativo para calcular proporciones y frecuencias de uso de indicadores de sostenibilidad, evaluar el impacto de la regulación en la composición de las carteras de inversión y determinar el grado de alineación de los fondos con la taxonomía de la UE. La metodología se fundamentó en estudios previos, como el de Badenhop et al. (2023), que analiza el impacto de la SFDR en la clasificación de fondos, y el de Krombholz et al. (2022), que evalúa el cumplimiento de los criterios de sostenibilidad en los fondos. Estos antecedentes sirvieron como base para estructurar el análisis y definir las variables clave a estudiar.

El cuarto estudio se enfocó en la definición, medición y priorización de recursos financieros destinados a inversiones sostenibles en tecnologías *Power-to-Gas* (PtG), así como en la identificación de indicadores para reportar su impacto social. Se plantearon preguntas de investigación sobre la influencia del entorno institucional en la movilización de recursos financieros, la priorización de estos recursos y la forma en que pueden medirse los impactos sociales.

Para responder a estas cuestiones, se utilizó un enfoque metodológico mixto. En primer lugar, se realizaron entrevistas híbridas para recopilar información cualitativa sobre la financiación y los impactos sociales relacionados con las tecnologías PtG en España. Estas preguntas se diseñaron a partir del análisis previo de documentación, adaptando indicadores de estudios anteriores sobre sostenibilidad e innovación tecnológica. La selección de las personas entrevistadas se llevó a cabo en colaboración con el gobierno regional, asegurando la representatividad dentro del sector energético y la

disponibilidad de los expertos para participar. Los resultados obtenidos fueron clasificados y analizados en función de las tres preguntas de investigación del estudio, lo que permitió comprender el papel de las instituciones, las prioridades de la financiación y los indicadores sociales asociados a estas tecnologías.

En segundo lugar, se complementaron las entrevistas realizadas en el primero a través de un estudio de caso que permitiera profundizar en la perspectiva de las entidades financieras en el apoyo a las inversiones sostenibles en tecnologías PtG. El estudio se centró en una entidad del sector financiero de tamaño medio que proporcionó información detallada sobre la gestión de recursos financieros en esta materia, permitiendo analizar estrategias y criterios de priorización en la financiación de tecnologías sostenibles.

El análisis cualitativo de las entrevistas y el estudio de caso permitieron comprender cómo el entorno institucional influye en la movilización de recursos financieros, qué factores determinan la priorización de estos recursos y cómo se pueden establecer métricas para evaluar el impacto social de las inversiones en tecnologías PtG.

En resumen, la relación entre la EC y el sector financiero radica en su papel clave para financiar negocios circulares y promover prácticas sostenibles. La integración de la EC en el *reporting* y la contabilidad medioambiental permite evaluar y divulgar los impactos de la EC a través de indicadores específicos. En este contexto, la Teoría de los *Stakeholders* resulta fundamental, ya que impulsa la adopción de prácticas circulares y exige mayor transparencia en la divulgación no financiera al sector financiero. Asimismo, la Teoría Institucional, a través de la regulación y el papel de las instituciones, fomenta y lleva al sector financiero a la necesidad de medir y divulgar sobre estas prácticas. De esta manera, ambos enfoques teóricos resultan esenciales para fortalecer e integrar la EC dentro del *reporting* sobre prácticas sostenibles del sector financiero. Por ello, a continuación, se analiza cómo el sector financiero se está adaptando a la regulación en materia de divulgación sobre EC y cómo identifica y financia inversiones en EC a través de la medición e integración en el *reporting* a los *stakeholders* desde un enfoque teórico.

2. Capítulo segundo. Definición y dimensionamiento del nivel de divulgación sobre economía circular en el sector financiero

2.1 Las Entidades Financieras Ante el Reto de la Taxonomía Europea de Inversiones Sostenibles y la información sobre Economía Circular

Este capítulo integra los resultados del primer estudio de la Tesis que ha sido publicado en la revista UCJC Business and Society, 19(73), 120-161, indexada en la Journal of Citation Report (JCR): Benito Bentué, D., Marco-Fondevila, M., & Scarpellini, S. (2022). Las Entidades Financieras Ante el Reto de la Taxonomía Europea de Inversiones Sostenibles y la información sobre Economía Circular. UCJC Business and Society Review 19(73), 120-161. <https://journals.ucjc.edu/ubr/article/view/4464>



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Las Entidades Financieras Ante el Reto de la Taxonomía Europea de Inversiones Sostenibles y la Información sobre Economía Circular¹

Financial institutions facing the challenge of the European taxonomy of sustainable investments and the circular economy disclosure

I. INTRODUCCIÓN

La Economía Circular (EC) se ha planteado desde distintos ámbitos como alternativa al modelo lineal basado en extraer, producir, usar y tirar, y con el fin de adaptar los modelos actuales a una economía de emisiones y residuos cero (Ellen MacArthur Foundation, 2015). Este modelo de cierre de círculos de los materiales no sólo es de aplicación a nivel macroeconómico, sino también en empresas y organizaciones que, de forma creciente, están introduciendo los principios de la EC en la producción y la prestación de servicios (Scarpellini, 2022). Ante el progresivo interés hacia la EC en el marco de las iniciativas para promoverla en Europa, en el año 2018, la Unión Europea (UE) adoptó el «Plan de Acción: Financiar el crecimiento sostenible»², a través del que lanzó una estrategia para el ámbito financiero con el objetivo de reorientar los flujos de capital hacia inversiones sostenibles. A tal fin, la UE estableció un sistema de clasificación unificado de inversiones sostenibles de carácter medioambiental como mecanismo de información en aras de la sostenibilidad. El mencionado Plan de acción desembocó en el Reglamento (UE) 2020/852 del Par-



RESUMEN DEL ARTÍCULO

Ante la puesta en marcha de la “Taxonomía europea de inversiones sostenibles” en la Unión Europea, en este artículo se analiza en qué medida las entidades del sector bancario informan a inversores sobre la economía circular para contribuir a los objetivos de sostenibilidad. A tal fin se analizan las memorias de sostenibilidad de una muestra de bancos españoles y se estudia el uso de instrumentos como el renting para modelos circulares a través de una entidad financiera como caso de estudio.

EXECUTIVE SUMMARY

In the face of the European taxonomy of sustainable investments launched by the European Union, this paper analyses how entities within the banking sector inform about the circular economy to their stakeholders, to contribute to sustainability objectives. To this end, we have analysed the sustainability reports of a sample of Spanish financial institutions. Besides, the use of financial instruments for circular models such as renting has been analysed as a case study for a specific financial company.

Es a las entidades financieras a las que les corresponde medir e informar acerca de las inversiones en actividades económicas que contribuyan a la sostenibilidad...

lamento Europeo y del Consejo denominado “Taxonomía europea de inversiones sostenibles” que supuso un cambio relevante en la información sobre sostenibilidad divulgada por las entidades financieras. Esta regulación europea persigue la adaptación del sistema financiero a los principios de sostenibilidad mediante la clasificación de inversiones y la homogeneización de las distintas categorías de impacto medioambiental.

Es a las entidades financieras a las que les corresponde medir e informar acerca de las inversiones en actividades económicas que contribuyan a la sostenibilidad, entre las que se contemplan también las que fomenten la EC para la mejora de la durabilidad, la reparación,

la actualización, la reutilización de los productos, o la reducción de recursos, el reciclaje y el consumo de recursos sostenibles (Marín-Vinuesa et al., 2021). Asimismo, se tienen que divulgar inversiones en actividades que permitan el desarrollo de nuevos modelos de negocio basados en servicios o el uso compartido, consiguiendo mantener y maximizar la utilidad y valor de los productos el mayor tiempo posible (Aranda-Usón et al., 2020).

La introducción de la EC, tanto en países asiáticos como en Europa, junto con el cambio de comportamiento del consumidor, está acelerando también la adaptación del sector financiero a modelos más circulares, aumentando también el número de estudios sobre EC y el denominado “green banking” (Meena, 2013), ya que, en este sector, se considera crucial promover la inversión socialmente responsable (Biswas, 2011), la “banca ética” (Harvey, 1995), y la sostenibilidad.

Sin embargo, el estudio específico de la introducción de la EC en el sector bancario y la divulgación de la información relacionada se encuentra en una fase de análisis aún muy incipiente (Di Vaio et al., 2022; Ozili, 2021). Por consiguiente, este *gap* en la literatura hace necesario analizar hasta qué punto la EC está siendo introducida en estas entidades, y en qué modo los indicadores financieros tradicionales puedan emplearse para el fomento de modelos de EC. Este análisis incluye los nuevos modelos de negocio basados en el alquiler o arrendamiento de servicios y cómo pueden facilitar el cierre de círculos de materiales en el marco de la EC, mejorando la eficiencia de los productos en la fase de uso.

Ante estas premisas, la finalidad general del estudio es dar respuesta al *gap* señalado, ampliando el conocimiento acerca de la implanta-

ción de los principios de la EC en el sector financiero. En particular, el objetivo principal es conocer en qué medida las entidades del sector bancario informan acerca de las actividades que realizan relacionadas con la EC ante la incipiente aplicación de la taxonomía europea de inversiones sostenibles. Asimismo, se pretende abordar el análisis de cómo los instrumentos financieros existentes pueden emplearse para el fomento de modelos circulares.

Para alcanzar estos objetivos, en este estudio se lleva a cabo un análisis cualitativo de doble enfoque metodológico, realizándose en primer lugar un análisis externo de la información no financiera sobre EC en una muestra de entidades bancarias españolas. Posteriormente, se explora la aplicación de un instrumento como el *renting* en el marco de la EC a través de entrevistas semiestructuradas realizadas a profesionales de un banco como caso de estudio en España.

PALABRAS CLAVE

Economía circular, Finanzas sostenibles; Renting; Contabilidad para la sostenibilidad; Taxonomía Europea.

KEYWORDS

Circular economy, Sustainable finance; Renting; Sustainability accounting; European taxonomy.

2. MARCO DE ANÁLISIS

El análisis del papel de las entidades financieras en la promoción de la EC es un tema reciente en la literatura y el marco de análisis de este estudio incluye dos ámbitos principales interrelacionados que se introducen en los apartados siguientes en el marco de la teoría de los *Stakeholders* (Freeman, 2011).

El desarrollo de este estudio no ha sido específicamente de índole teórica, pero en el marco de la taxonomía europea de finanzas sostenibles, la teoría de los *Stakeholders* permite una mejor comprensión de la divulgación ambiental de la EC tanto para las acciones internas de las instituciones financieras como para sus inversiones para la promoción la EC. La capacidad de alinear los objetivos estratégicos con la involucración de los *stakeholders* es un desafío clave para las empresas que deciden implementar modelos de negocio circulares (Salvioni & Almici, 2020). Algunos autores utilizan la teoría de los *Stakeholders* para explorar el impacto de la presión de los grupos de interés sobre las acciones de las empresas en materia de EC y, tradicionalmente, el análisis de la responsabilidad social corporativa (RSC) en el sector financiero español se ha abordado desde este marco teórico (Pérez-Ruiz & del Bosque, 2012).

Estas bases teóricas a menudo explican la divulgación de acciones para la sostenibilidad (Qureshi et al., 2019) y las relaciones entre las entidades financieras y otras actividades comerciales en sectores con impacto ambiental han llevado a sus grupos de interés a exigir

una mayor transparencia. Es por ello que desarrollamos nuestro análisis del *reporting* de la EC en el sector financiero desde el marco de la teoría de los *stakeholders*.

2.1. Economía Circular y Sector Financiero

La introducción de la EC plantea una serie de desafíos y de oportunidades para el sector financiero tanto en lo relacionado con la financiación de inversiones (Aranda-Usón et al., 2019; Ozili & Opene, 2021), como para la introducción de los principios de la EC en las propias entidades. Entre las implicaciones que el modelo circular tiene a nivel sectorial, podemos mencionar: la extensión de la vida útil de los productos que supone replantear la evaluación de los factores colaterales y el riesgo, en particular el crediticio; la implantación de indicadores relevantes para el seguimiento, la pérdida en caso de incumplimiento o la exposición (Zhelyazkova, 2021); y los productos y préstamos directos a medio y largo plazo específicos para proyectos de economía circular a pequeña y gran escala.

No cabe duda de que el sector financiero tiene también que incorporar paulatinamente los principios de la EC en sus propias operaciones y en el futuro próximo los bancos tendrán que informar acerca de los fondos para la EC y las decisiones de inversión a través de métricas específicas (Gunarathne et al., 2021). Estos objetivos pueden alcanzarse a través de entidades que propicien el retorno de inversiones medioambientalmente sostenibles, de planes de formación dirigidos al personal para el cumplimiento de la regulación en materia de EC y que sus profesionales sepan valorar oportunamente las inversiones en EC, o instaurando prácticas internas sobre la base de los valores circulares como el reciclaje, la disminución de residuos o el planteamiento de otros usos de productos y materiales que alarguen su vida útil (Ozili & Opene, 2021).

También estas acciones internas requieren un esfuerzo de *accountability* por parte del sector financiero, al objeto de informar acerca de sus logros en la introducción de los principios circulares a través de información no financiera, que se tiene que contemplar en los informes de sostenibilidad. Sin embargo, algunos autores han señalado que la divulgación no financiera en cuanto a impactos medioambientales es aún una práctica algo difusa en las entidades europeas y cabe esperar que la EC sufra de las mismas barreras (Dewick et al., 2020; Gunarathne et al., 2021).



En la literatura, son aún poco numerosos los autores que han analizado explícitamente los impactos de los bancos en la EC y la sostenibilidad con la información correspondiente (Bonifácio Neto & Branco, 2019). Estudios anteriores han explorado cómo los informes de sostenibilidad de las instituciones financieras incorporan consideraciones ambientales y sociales en sus sistemas de gestión de riesgos (Gambetta et al., 2021), o han analizado los informes de sostenibilidad de los bancos y sus vínculos con los valores de la RSC (Chang et al., 2019; De La Cuesta-González et al., 2006). No hay duda de que el sector financiero puede contribuir sustancialmente al desarrollo sostenible (Bonifácio Neto & Branco, 2019; Jayabal & Soundarya, 2016), y el *reporting* puede conllevar para los bancos y otras instituciones financieras un incremento de sus acciones para la sostenibilidad (Joseph, 2012).

La revisión sistemática de la literatura que ha analizado los aspectos financieros de la EC llevada a cabo por Gonçalves et al., (2022) pone de manifiesto que solamente unos pocos estudios investigan los aspectos corporativos del modelo circular específicamente en entidades financieras, a pesar de que se ha señalado que los recursos financieros son un factor clave para el despliegue de la EC (Aranda-Usón et al., 2019; Darmandieu et al., 2022). Además, los empleados del sector, disponen aún de un conocimiento limitado de las implicaciones sectoriales de la EC (Zhelyazkova, 2021).

En términos generales, los resultados de investigaciones anteriores indican que los informes de sostenibilidad tienden a centrarse más en las emisiones y los impactos ambientales, mientras que la EC no es de momento un tema prioritario en los informes (Janik et al., 2020). Sin embargo, existe un nivel creciente de divulgaciones implícitas de las acciones relacionadas con la EC para mejorar el desempeño de la sostenibilidad a nivel organizacional (Gunarathne et al., 2021). A pesar de que se demande un esfuerzo conjunto por parte de sectores públicos y privados para la implantación de las finanzas sostenibles en modelos de negocio circulares (Sepetis, 2021), solamente unos pocos estudios previos han analizado de forma específica las prácticas de información relacionadas con la EC en el sector financiero (Di Vaio et al., 2022; Ozili & Opene, 2021).

A modo de introducción, podemos afirmar que la inclusión de información relacionada con la EC en los informes de sostenibilidad de las instituciones financieras es una línea de investigación muy incipiente. Es por ello que en este estudio se investiga de qué modo el sector





está respondiendo a los desafíos planteados por la taxonomía de finanzas sostenibles de la UE en la divulgación de información sobre la EC.

Es en este marco en el que las entidades financieras tienen que desarrollar mecanismos de medición e indicadores específicos para informar acerca de sus actividades internas, por ejemplo, en lo relacionado con la EC, como por su función de intermediario para los instrumentos de financiación, de manera similar a lo señalado para la RSC en el sector bancario (De La Cuesta-González et al., 2006). Así, instrumentos tradicionales de financiación como el *renting* resultan ahora de interés por su potencial para fomentar el cambio de modelo hacia una economía de los servicios que puede considerarse ligada al cierre de círculos, proporcionando el uso de los bienes a los usuarios sin necesidad de ostentar su propiedad (Bocken et al., 2016).

En los últimos años, el nivel de información de carácter voluntario en temas medioambientales ha ido en aumento en las memorias de sostenibilidad de los bancos en aplicación del Reglamento (UE) 2019/2088³ sobre la divulgación de información relativa a la sostenibilidad en el sector de los servicios financieros (posteriormente modificado por el Reglamento UE 2020/852 ut supra). Asimismo, la incorporación de productos sostenibles en el sector financiero y la introducción de la EC en empresas ha supuesto que cada vez sean mayores los esfuerzos de las entidades del sector por financiar inversiones que fomenten la EC, e informar sobre ellas en respuesta a los grupos de interés como parte de toda su estrategia de sostenibilidad (Marco-Fondevila et al., 2021).

Ante estas consideraciones, en este estudio se plantea una primera pregunta al objeto de definir hasta qué punto las entidades financieras informan sobre EC de cara a la taxonomía europea de inversiones sostenibles (P-1).

2.2. El Renting en un Modelo Circular

Un cambio de modelo que priorice grandes volúmenes de bienes arrendados en lugar de productos en propiedad supone para los bancos aspectos tanto positivos como negativos. Por un lado, las entidades financieras no tienen la posibilidad de aceptar el bien como garantía de los préstamos, ya que estos bienes siguen siendo propiedad de los gestores que ofrecen el servicio de arrendamiento financiero. Sin embargo, por otro lado, el uso masivo de bienes arrendados puede suponer una expansión del mercado para las entidades

financieras, ya que más usuarios pueden acceder al uso de los bienes (Zhelyazkova, 2021).

De hecho, entre las implicaciones que la EC está suponiendo para las entidades financieras, se contempla el fomento del arrendamiento financiero y la participación de los propios bancos en proyectos compartidos dentro de modelos de economía colaborativa y circulares (Ozili, 2021). De allí que el *renting* haya sido recientemente señalado como uno de los instrumentos de aplicación en el marco de la EC, dado que mejora los índices de impacto medioambientales de la entidad gestora al favorecer un menor nivel de emisiones de flotas de vehículos, más modernos y eficientes al tratarse de *renting*.

No obstante, como se ha señalado anteriormente, el impacto del *renting* es aún un tema poco estudiado en el marco de la EC, y este análisis tiene el objetivo de abordar este *gap* en la literatura. Es por ello que se plantea una segunda pregunta de investigación para explorar la relación entre el *renting* y el modelo circular en el sector financiero en el marco de la EC (P-2).



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3. METODOLOGÍA Y MUESTRA

Al objeto de responder a las principales preguntas formuladas y así arrojar nueva información para la implantación de la EC en el sector financiero, se planteó una metodología de carácter cualitativo de doble enfoque: un análisis externo de información no financiera a nivel sectorial a partir de las memorias de sostenibilidad o similar de entidades españolas, y un caso de estudio llevado a cabo en una de las entidades de la muestra en la que se realizaron entrevistas semi-estructuradas a profesionales.

3.1. Análisis de Accountability y Muestra

El análisis se realizó sobre la muestra de 12 entidades financieras detalladas en la Tabla siguiente que fueron seleccionadas a partir de los datos de la base de datos SABI entre las de mayor tamaño registradas bajo el epígrafe NACE “Actividades financieras y seguros” en España:

Tabla 1. Ranking de Entidades financieras españolas por volumen de activos totales de la anualidad 2019.

ENTIDADES FINANCIERAS	ACTIVOS TOTALES (MILLONES DE EUROS)
Banco Santander, S.A.	1.517.885
Banco Bilbao Vizcaya Argentaria, S.A.	698.690
Caixabank, S.A.	391.414
Banco de Sabadell, S.A.	223.753
Bankia, S.A.	208.468
Bankinter, S.A.	83.732
Kutxabank, S.A.	59.580
Abanca Corporación Bancaria, S.A.	58.879
Unicaja Banco, S.A.	56.708
Ibercaja Banco, S.A.	55.422
Liberbank, S.A.	46.814
Cajamar Caja Rural, Sociedad Cooperativa de Crédito	47.406

Fuente: Base de Datos SABI⁴

Para el análisis externo de la información se recopilaron las memorias de sostenibilidad o informes integrados de las entidades integrantes la muestra y se comprobó que todas ellas aplicaran los estándares GRI (GRI, 2021). Los informes fueron analizados a través de motores de búsqueda específicos aplicados por los autores para destacar toda la información relevante relacionada con la EC.

El análisis se llevó a cabo empleando una metodología desarrollada a tal fin sobre la base de los indicadores GRI vinculados a la EC de aplicación en el sector financiero, de manera que los datos e información de las diferentes entidades pudieran ser comparables bajo los mismos estándares. Considerando la actividad del sector, los temas relevantes en el ámbito de la EC están asociados a las emisiones de carbono y a la generación y gestión de residuos. Los indicadores GRI seleccionados se resumen en la **Tabla 2**, para los que se plantean dos niveles de análisis.

En primer lugar, se comprobó si las entidades seleccionadas informan en las memorias acerca de los indicadores, dando lugar cada uno de ellos a una variable proxy para comprobar la amplitud de los indicadores empleados por cada entidad (Análisis 1).

Posteriormente, se realizó un análisis cualitativo de la información a través de la búsqueda de términos relacionados con la sostenibilidad y, en particular con la EC: modelo circular, no lineal, cierre de círcu-

Tabla 2. Variables empleadas para el análisis externo de las memorias de sostenibilidad de las entidades financieras.

VARIABLES ANALIZADAS	ANÁLISIS 1	ANÁLISIS 2
305-1 Emisiones directas de GEI (alcance 1).	Indicadores: emisiones directas de GEI (alcance 1) de la organización.	Información sobre emisiones realizadas por los trabajadores en vehículo.
305-3 Otras emisiones indirectas de GEI (alcance 3).	Indicadores: emisiones indirectas de GEI (alcance 3).	Información sobre emisiones realizadas por los vehículos ofertados a través de renting.
305-5 Reducción de las emisiones de GEI.	Indicadores: reducción de las emisiones de GEI.	Información sobre estrategias para reducir emisiones de los vehículos o incorporación de coches híbridos, eléctricos, ECO, etc.
306-1 Generación de residuos e impactos significativos relacionados con los residuos.	Indicadores: impacto de los residuos generados a través de su actividad.	Información sobre el tratamiento de residuos procedentes de vehículos e información sobre posibles impactos relacionados con el renting.
306-2 Gestión de impactos significativos relacionados con los residuos.	Indicadores de medición de circularidad.	Información al consumidor sobre criterios de medio ambiente e información de medidas de circularidad relacionadas con el renting.
306-3 Residuos generados.	Indicadores: residuos generados.	Información sobre baja de vehículos o reparados para su reutilización.
306-4 Residuos no destinados a eliminación.	Indicadores: residuos no destinados a eliminación.	Información acerca del proceso que se sigue para la reparación y posterior uso.
306-5 Residuos destinados a eliminación.	Indicadores: residuos destinados a eliminación.	Información sobre el proceso de gestión de la eliminación de vehículos.

Elaboración propia a partir de Marco-Fondevila et al. 2021)

los, EC, circularidad, y otros términos seleccionados a partir de ocho indicadores GRI, dando lugar a un conjunto de 16 sub-variables a analizar (**Tabla 2**). Además, se realizó una búsqueda exhaustiva de términos, actividades y otra información relacionada con el *renting* y, en su caso, si se relacionaba con el ámbito de la EC en las memorias. En resumen, se realizaron dos niveles de análisis en línea con otros autores quienes señalan diferentes niveles de información relacionada con la EC en las prácticas de *reporting* (Gunarathne et al., 2021; Sanches et al., 2022). El objetivo fue el de evaluar la *accountability* en materia de sostenibilidad medioambiental y EC, y un segundo análisis específico de la información divulgada sobre el uso del *renting* en el marco de la EC. El objetivo fue observar la divulgación de información sobre EC y su relevancia en los informes de las entidades seleccionadas.

Como segunda fase de investigación, se llevó a cabo un estudio del caso de una de las entidades de la muestra para obtener información específica acerca del nivel de proactividad en EC en el sector y conocer la opinión de los profesionales acerca de la potencial relación entre instrumentos convencionales como el *renting* y el modelo circular en el sector financiero. A tal fin se realizaron 10 entrevistas semi-estructuradas a directivos y profesionales de la entidad seleccionada para el caso de estudio, detallándose sus perfiles en la **Tabla 3**.

Tabla 3. **Perfiles de los entrevistados.**

EDAD	GÉNERO	PUESTO	NIVEL DE FORMACIÓN
52	M	Director	Post-graduado
51	M	Director	Post-graduado
51	H	Gerente	Graduado universitario
49	H	Director	Post-graduado
37	M	Técnico	Post-graduado
57	H	Gerente	Graduado universitario
49	H	Gerente	Post-graduado
N.D.	N.D.	N.D.	N.D.
48	H	Director	Graduado universitario
N.D.	N.D.	N.D.	N.D.

Los cuestionarios con las preguntas (**Tabla 4**) se remitieron con antelación a los entrevistados y la realización de las entrevistas se llevó a cabo a través de conexión telemática conjuntamente por dos miembros del equipo de investigación, con una duración aproximada de entre 20 y 30 minutos para cada entrevista.

En las entrevistas semi-estructuradas se incluyeron preguntas abiertas para que los entrevistados pudieran proporcionar su opinión, y también se recabaron opiniones más específicas a través de una escala Likert (siendo cero “poco relevante” y 10 “muy relevante”). Los resultados de las encuestas y las opiniones emitidas por los entrevistados fueron tratados de forma anónima y los resultados se presentan de manera agregada.

Tabla 4. Principales preguntas de la entrevista semi-estructurada para el caso de estudio.

CÓDIGO	PREGUNTAS ENTREVISTA
EC	Percepción del entrevistado acerca de la relevancia de la EC para la entidad
EC-sector	Opinión del entrevistado acerca de la relevancia de la EC en el sector
SHAR uso compartido	Opinión del entrevistado acerca de si en la entidad se fomenta el uso compartido de bienes entre la plantilla (<i>renting</i> , flota de vehículos corporativo o similar, etc.)
ACT otras actividades	Otras ACTIVIDADES señaladas por el entrevistado llevadas a cabo por la entidad en relación con la sostenibilidad
CA_01-REN <i>renting</i>	Opinión del entrevistado acerca del <i>renting</i> como instrumento de sostenibilidad
CA_01-EC <i>renting</i>	Opinión del entrevistado de la relación entre el <i>renting</i> y la EC
C.1_Vehiculos	¿El <i>renting</i> favorece el acceso al uso de vehículos más sostenibles?
C.2_Car-Sha car sharing	¿El <i>renting</i> está relacionado con el “ <i>car-sharing</i> ”?
C.3_totveh Más veh	¿El <i>renting</i> favorece el aumento del número de vehículos?
C.4_MAT menos mat	¿El <i>renting</i> favorece la disminución del consumo de materias primas?
C.5_Tech nuevas tecnología	¿El <i>renting</i> facilita la aceptación de nuevas tecnologías en vehículos?
C.6_CARB menos emisiones	¿El <i>renting</i> favorece la disminución de emisiones de carbono?
C.7_FOS menos fósil	¿El <i>renting</i> favorece la disminución del consumo de combustibles fósiles?
C.7A_Otro	Otras cuestiones relacionadas con el <i>renting</i> ?
C.8_MOV movilidad sost.	¿El <i>renting</i> fomenta la movilidad sostenible?
C.9_INTEN + intensidad uso	¿El <i>renting</i> favorece una mayor intensidad de uso de vehículos?
C.10_Uso menor coste uso	¿El <i>renting</i> disminuye el coste del uso de vehículos?
C.11_ACEPT + aceptación tec	¿El <i>renting</i> facilita la aceptación de nuevas tecnologías en vehículos?
C.12_SHARC Sharing corporativo	En la Entidad ¿Sería viable el “ <i>car-sharing</i> ” corporativo para trabajadores?
C.13_COMPA sharing particular	En la Entidad ¿Sería viable el uso compartido de vehículos particulares?
C.13A_Otro	Otras cuestiones relacionadas con el “ <i>car-sharing</i> ”

4. PRINCIPALES RESULTADOS

Los resultados obtenidos se resumen en los dos sub-apartados siguientes según el orden metodológico adoptado en el análisis.

4.1. Análisis Externo de la Información

Los resultados del análisis externo de la información no-financiera sobre sostenibilidad y la EC indican que las entidades que integran la muestra informan ampliamente acerca de sus actividades para la reducción de residuos, el consumo de materiales y recursos, y el reciclaje. Se observa cierta disparidad en la información inherente a

algunas de las actividades relacionadas con la EC, como por ejemplo el reacondicionamiento de dispositivos eléctricos, la cesión de equipos informáticos a organizaciones sin ánimo de lucro, o de líneas de financiación basadas en sostenibilidad y/o específicas para inversiones en EC. Algunas de las entidades, además de proporcionar información acerca de estas actividades, también informan sobre el uso de coche compartido a través de *carpooling* o *car-sharing* y del apoyo al uso de medios de transporte de bajo nivel de emisiones. Sin embargo, a pesar de que algunas de las actividades divulgadas en las memorias de sostenibilidad o integradas estuvieran relacionadas con los principios circulares, se observa que estas entidades no las relacionan directamente con la EC.

En algunas de las memorias analizadas, la EC se encuentra mencionada en lo inherente a educación y formación de empleados en términos medioambientales y de circularidad. En respuesta a la primera pregunta de este estudio (P-1), puede afirmarse que las entidades informan ampliamente sobre sus emisiones, impactos, y los residuos generados, proporcionando altos niveles de *accountability*, pero no se informa de manera directa acerca de las actividades llevadas a cabo para la implantación y el fomento de la EC. Entre los indicadores empleados con menor frecuencia se destacan los relacionados con el tratamiento de residuos, mientras que suele ser amplia la información sobre los residuos generados y la reducción de emisiones en las entidades analizadas (Tabla 5).

Tabla 5. Resultados del primer nivel de análisis.

INDICADORES	MEDIA
305-1 Emisiones directas de GEI (alcance 1).	83.33%
305-3 Otras emisiones indirectas de GEI (alcance 3).	83.33%
305-5 Reducción de las emisiones de GEI.	75.00%
306-1 Generación de residuos e impactos significativos relacionados con los residuos.	75.00%
306-2 Gestión de impactos significativos relacionados con los residuos.	75.00%
306-3 Residuos generados.	83.33%
306-4 Residuos no destinados a eliminación.	33.33%
306-5 Residuos destinados a eliminación.	33.33%

El segundo nivel de análisis de la información no financiera proporcionada por las entidades financieras confirma la tendencia obtenida

a través del análisis de primer nivel, arrojando aún más diferencias entre los ámbitos de información y poniendo de manifiesto la escasa relevancia que los indicadores relativos a residuos tiene para el sector (**Tabla 6**).

Tabla 6. Resultados del segundo nivel de análisis.

INDICADORES	MEDIA
305-1 Emisiones directas de GEI (alcance 1).	25.00%
305-3 Otras emisiones indirectas de GEI (alcance 3).	8.33%
305-5 Reducción de las emisiones de GEI.	16.67%
306-1 Generación de residuos e impactos significativos relacionados con los residuos.	8.33%
306-2 Gestión de impactos significativos relacionados con los residuos.	0.00%
306-3 Residuos generados.	0.00%
306-4 Residuos no destinados a eliminación.	0.00%
306-5 Residuos destinados a eliminación.	0.00%

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Cabe mencionar que, en las memorias analizadas, no se observó información específica acerca del uso de instrumentos financieros como el *renting* en relación al modelo circular y a su implantación en las entidades o en general.

4.2. Caso de Estudio: Información Sobre Renting y Economía Circular en Entidades Financieras

Los resultados obtenidos a través de las entrevistas realizadas, ponen de manifiesto el interés de la entidad hacia la EC (**Tabla 7**), tanto en lo que concierne a su adopción en la propia organización, como para su promoción y fomento a través de productos financieros y financiación de inversiones específicas.

Tabla 7. Nivel de relevancia de la EC para la entidad, en opinión de los entrevistados.

	RELEVANCIA DE LA EC PARA LA ENTIDAD N° de entrevistados
BAJA	0
MEDIA	2
ALTA	7
NS/NC	1

No obstante, cabe mencionar que, según los directivos entrevistados, el plazo de despliegue de la EC se prevé largo (**Tabla 8**).

Tabla 8. Opinión de los entrevistados acerca del plazo previsto de implantación de la EC en el sector.

	PLAZO PREVISTO DE IMPLANTACIÓN EC Nº de entrevistados
MENOS DE 3 AÑOS	2
ENTRE 3 Y 5 AÑOS	6
ENTRE 6 Y 10 AÑOS	0
MÁS DE 10 AÑOS	1
OTRO	1

En lo relativo al análisis de la relación entre instrumentos financieros como el *renting* y la EC a nivel sectorial y en la propia entidad objeto de estudio, los resultados de las entrevistas confirman que, hasta la fecha, las entidades del sector bancario no asocian de forma directa la EC con las actividades que realizan en ámbito medioambiental o con el *renting*. Las opiniones recabadas pusieron de manifiesto que, una vez propuesta la relación entre este instrumento y la EC, los propios directivos reconocieron el *renting* como factor potenciador de modelos circulares en el futuro, por ejemplo, en lo relacionado con el *car-sharing* (**Tabla 9**).

Los entrevistados consideraron el *renting* como apto para algunos de los principales objetivos de la EC como pueden ser la reducción de emisiones, la sustitución de los combustibles fósiles y la mejora medioambiental derivada del acceso a vehículos más sostenibles gracias al uso del *renting*. A partir del análisis de las respuestas obtenidas puede observarse cómo este instrumento podría favorecer la disminución del número de vehículos, aunque la rotación de flotas pueda ser más rápida que el cambio de un vehículo particular, la intensidad de uso aumenta y por tanto el parque automovilístico total podría disminuir.

En respuesta a la segunda pregunta de análisis (P-2), se desprende de las entrevistas que el *renting* puede relacionarse con la EC ya que favorece una movilidad sostenible y la aceptación de nuevas tecnologías. Pudieron también observarse diferencias de opinión en cuanto a la relación entre el *renting* y el *car-sharing* y, en algunos casos, entre estos términos y la EC. Tampoco se observan niveles elevados de

Tabla 9. Opinión de los entrevistados acerca del plazo previsto de implantación de la EC en el sector.

	BAJO [ENTRE 0 Y 4 O NS/NC]	MEDIO [ENTRE 5 Y 7]	ALTO [ENTRE 8 Y 10]	MEDIA	MEDIANA	MODA	DESVEST
C.1_Mejora vehículos	0	0	● 10	9.0	9.0	9.0	0.82
C.2_Car sharing	1	5	▲ 4	7.1	7.0	7.0	2.42
C.3_Más vehículos	5	4	◆ 1	3.7	3.5	5.0	2.75
C.4_Menos materiales	2	4	▲ 4	6.3	7.0	8.0	2.50
C.5_Nuevas tecnologías	0	0	● 10	9.4	9.0	9.0	0.52
C.6_Menos emisiones	0	1	● 9	8.9	9.0	9.0	0.99
C.7_Menos combust. fósil	0	1	● 9	8.6	9.0	8.0	1.51
C.8_Movilidad sostenible	0	0	● 10	9.4	10.0	10.0	0.84
C.9_Mejor intensidad uso	1	4	▲ 4	6.3	7.0	7.0	2.75
C.10_Coste de uso inferior	0	2	● 8	8.6	9.0	9.0	1.58
C.11_Aceptación tecnol.	0	1	● 9	9.0	9.0	9.0	0.94
C.12_Sharing corporativo	0	6	▲ 4	7.4	7.0	7.0	1.35
C.13_Sharing particular	0	6	▲ 4	6.8	7.0	8.0	1.75

interés para la implantación de modelos de *car-sharing* corporativo en la entidad, en algunos casos justificados con la opinión de que se deben fomentar otros medios de transporte más sostenibles.

Entre las opiniones más frecuentes recabadas a través de las entrevistas, cabe destacar que la falta de indicadores específicos de EC y el de tratamiento de datos correspondiente limitan la información acerca del uso del *renting* en relación con la EC. Algunos entrevistados manifestaron no percibir claramente la relación entre el *renting*, el *car-sharing* y la implantación del modelo circular en el sector automovilístico para un cambio de modelo de negocio. Por lo contrario, otros participantes veían la posibilidad de desarrollar nuevos productos a través del *renting* basándose en intensificación de uso y la reutilización de vehículos, desarrollando productos de *car-sharing* y operaciones financieras cuyo coste fuera inferior con vehículos de contratos de *renting* ya finalizados.

4.3. Algunos de los Argumentos a Debat

Los resultados permiten debatir para una mejor comprensión de los procesos de integración de la EC en las prácticas de información y analizar así el papel potencial del *renting* en el despliegue de mode-



los circulares en el sector financiero. En línea con otros autores como Gunarathne et al. (2021) y Marco-Fondevila et al. (2021), en nuestro estudio se detectan niveles bajos o muy bajos de divulgación de palabras clave, directa y explícitamente relacionadas con EC. Este resultado confirma la capacidad limitada en la actualidad de los bancos y otras instituciones financieras en el ámbito de la EC, como ya se ha detectado en el análisis de los informes de sostenibilidad para otros sectores (Khan et al., 2020).

La aplicación en la UE de la Taxonomía para la EC, conlleva necesariamente algunos ajustes por parte de las entidades financieras en la medición e información tanto de sus actuaciones internas como las relacionadas con la financiación de inversiones de EC. A partir del análisis realizado, la selección de los indicadores de EC es una aportación inicial para los informes de sostenibilidad existentes (Opferkuch et al., 2021, 2022). En concreto, los resultados aquí obtenidos corroboran las recomendaciones de Opferkuch et al. (2022) para que las instituciones y agencias de clasificación contemplen la evaluación de la EC. Además, ante las principales consideraciones de Palacios-González y Chamorro-Mera (2020), también es recomendable que en las estrategias de comunicación de las entidades se destaquen aspectos de la EC para incrementar la percepción de una fuerte vinculación con los principios de la sostenibilidad (Moneva et al., 2006).

5. CONCLUSIONES

El principal objetivo de este estudio se alcanzó a través de un doble enfoque metodológico de carácter cualitativo: el análisis externo de la información no-financiera de EC en una muestra de entidades del sector financiero español y la realización de entrevistas semi-estructuradas en una de las entidades como caso de estudio para determinar el papel de instrumentos de financiación convencionales como el renting en la implantación de la EC en el sector.

Se ha analizado tanto el nivel de *accountability* en EC de las entidades analizadas, como los indicadores GRI de sostenibilidad medioambiental más divulgados por los bancos para que puedan emplearse en el marco de la EC como parte de las actividades necesarias para el cierre de círculos de materiales.

Nuestro análisis revela que las entidades financieras informan acerca de la reducción de residuos, la evolución de los consumos (energía

y agua en particular) y el reciclaje. En menor medida, se revela información acerca de acciones más propias de modelos circulares en actividad interna de reacondicionamiento de dispositivos, o el alargar la vida útil de equipos, y algunas entidades informan sobre líneas de financiación para la sostenibilidad.

En respuesta a la demanda institucional, queda patente la necesidad de aumentar y mejorar la información proporcionada sobre acciones y fondos específicos para inversiones en EC. Además, se plantea un mayor grado de *accountability* en lo que concierne a modelos de servitización y compartidos de los que, indudablemente, el sector será participe en el corto y medio plazo. Estos resultados permiten alinear los principales indicadores sobre los aspectos financieros de la EC con los análisis académicos de información específica sobre EC y las prácticas de rendición de cuentas esperadas en la aplicación de la taxonomía europea.

En este artículo se proporciona evidencia empírica específica para la divulgación no financiera con el fin de confirmar el uso de indicadores genéricos y específicos de EC para los procesos de información en instituciones financieras que han asumido un papel más activo en la promoción de inversiones circulares. Los profesionales del sector pueden aplicar estos indicadores: esto significaría una mayor rendición de cuentas relacionada con la EC, pero requeriría un conocimiento más detallado de las inversiones, fondos y otras actividades relacionadas con el cierre de círculos de materiales.

Este estudio destaca el renting como un instrumento relevante utilizado en modelos circulares y las principales conclusiones alcanzadas resultan de utilidad tanto para futuros estudios en la materia como para los profesionales que tomen decisiones sobre la financiación de modelos compartidos a través de diferentes soluciones de renting que tengan en cuenta los beneficios relacionados en términos medioambientales y circulares. Primero, nuestros hallazgos se traducen directamente en prácticas que son los principales indicadores para reportar la EC en las entidades financieras. En segundo lugar, este estudio aborda la brecha entre académicos y profesionales al examinar la medición de los contratos de renting desde el marco conceptual de la EC: los principales resultados pueden ser aplicados por los administradores para definir y medir las mejoras ambientales específicas logradas mediante el fomento de instrumentos convencionales revisados bajo el prisma circular.



Este estudio será de utilidad para futuros trabajos de investigación, dados los indicadores inéditos analizados y la novedosa gama de variables relacionadas con la actividad de renting. Sin embargo, cabe destacar algunas limitaciones del trabajo relacionadas con el tamaño de la muestra y su ámbito nacional. Nuestro análisis empírico se limita a España y puede no representar a otros países con sectores financieros que tengan estructuras o características diferentes, especialmente fuera de la UE. Además, a pesar de los esfuerzos aplicados para realizar un análisis de texto de los informes integrados de la manera más precisa, cabe mencionar algunas dificultades relacionadas con la falta de uniformidad de los indicadores y de las definiciones de lo que se considera EC. Por lo tanto, se recomiendan más estudios de carácter comparativo.



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2. Véase: <https://ec.europa.eu/transparency/regdoc/rep/1/2018/ES/COM-2018-97-F1-ES-MAIN-PART-1.PDF> (consultado en diciembre de 2021)
3. Véase: <https://www.boe.es/doue/2019/317/L00001-00016.pdf> (consultado en diciembre de 2021).
4. Para la realización del análisis el orden de las entidades se aplicó aleatoriamente y no corresponde al orden de la Tabla 1.



3. Capítulo tercero. Contabilidad medioambiental aplicada al sector financiero para el *reporting* de la economía circular

3.1 “Viejos” instrumentos financieros en “nuevos” modelos circulares: Contabilidad medioambiental aplicada al sector financiero para el *reporting* de la economía circular

En este tercer capítulo se incluyen los resultados obtenidos a partir del segundo estudio llevado a cabo para la Tesis y publicado en la Spanish Accounting Review, 26(Special), 34–45, indexada en el Journal of Citation Report (JCR): Marco-Fondevila, M., Benito-Bentué, D., & Scarpellini, S. (2023). “Old” financial instruments in “new” circular models: Applied environmental accounting in the banking sector for *reporting* in a circular economy. <https://doi.org/10.6018/rcsar.576251>



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"Old" financial instruments in "new" circular models: Applied environmental accounting in the banking sector for reporting in a circular economy

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ABSTRACT

The role of commercial banks and financial institutions has been described as crucial for the circular economy since they are key actors in financing companies and projects. The facilitating potential of some financial instruments managed by the financial sector has not been studied in connection to extending the circular economy in the environmental accounting framework. Particularly, the renting contracts service, which has been associated with more sustainable performance, shows interesting circular characteristics for servitization and the sharing economy.

By studying the details of renting contracts of a financial institution over 18 years as a case study in Spain, this research demonstrates how this type of service, applied to vehicles, can render important benefits in terms of use of resources, environmental impact, energy efficiency and reduced carbon emissions. Measuring these quantitative impacts and reporting about them is important from an environmental accounting basis and in the framework of the European Union taxonomy for sustainable finance.

The results obtained from the stakeholders perspective highlight the pivotal role of existing financial instruments and the need for new metrics for reporting linked to the servitization of the economy as a specific circular issue. This paper contributes to the academic literature by bringing empirical results to a still recent line of research. For practitioners, we provide innovative metrics for circular economy in the financial sector, and for policymakers, this research highlights the wider role of financial institutions in promoting circular economy within the sustainability framework.

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"Viejos" instrumentos financieros en "nuevos" modelos circulares: Contabilidad medioambiental aplicada al sector financiero para el reporting de la economía circular

RESUMEN

El papel de los bancos y las instituciones financieras ha sido calificado como crucial para la economía circular, como actores clave para financiar empresas y proyectos. El potencial facilitador de algunos instrumentos financieros gestionados por el sector financiero no ha sido estudiado en relación con el fomento de la economía circular en el marco de la contabilidad medioambiental. En particular, el servicio de renting, que se ha asociado a un rendimiento más sostenible, muestra interesantes características vinculadas a la economía circular y a la servitización de la economía.

Analizando en detalle los contratos de renting de una entidad financiera durante 18 años como caso de estudio en España, este estudio demuestra cómo este tipo de servicios, aplicado a los vehículos, puede aportar importantes beneficios en cuanto al uso de recursos, impacto ambiental, eficiencia energética y reducción de emisiones de carbono. Medir cuantitativamente e informar acerca de estos impactos es relevante para la contabilidad medioambiental en el marco de la Taxonomía Europea de finanzas sostenibles.

Los resultados obtenidos desde la perspectiva de los stakeholders destacan el papel fundamental de los instrumentos financieros existentes y la necesidad de nuevas métricas para el reporting vinculado a la servitización de la economía como un tema circular específico. Este trabajo contribuye a la literatura académica proporcionando resultados empíricos a una línea de investigación aún incipiente. Para los profesionales, se aportan métricas novedosas para la economía circular en el sector financiero, mientras que, para la definición de políticas de sostenibilidad, esta investigación pone de relieve el amplio papel de las instituciones financieras en la promoción de la economía circular.

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1. Introduction

In response to institutional demand, reducing the consumption of materials and resources within the circular economy (CE) requires a greater definition and control of the company's material loops closing (Aranda-Usón et al., 2020; Scarpellini et al., 2017). The circular model implies changes at different organization's levels, including accounting processes in the framework of sustainability accounting and accountability (Scarpellini et al., 2020). In the coming years, the CE-related activities and impacts will be part of the information reported within the framework of Directive (EU) 2022/2464 as regards to corporate sustainability reporting (Directive (EU) 2022/2464 as regards Corporate Sustainability Reporting, 2022). Consequently, sustainability reports have to contain information on the extent to which the companies have managed to introduce the CE.

These progress towards CE requires not only institutional and market forces, but also adaptation in all sectors, including the financial one. This need for adaptation in financial products is what has led the European Union (EU) to consider the financial sector as a key actor to favour the sustainable functioning of the economy and the promotion of the CE. A clear sign of this aim is reflected by its integration in sustainable finance through the so-called European Taxonomy regulated by the Regulation (EU) 2020/852 of the European Parliament and the Council, on the establishment of a framework to facilitate sustainable investment (Regulation (EU) 2020/852 on the Establishment of a Framework to Facilitate Sustainable Investment, and Amending Regulation (EU) 2019/2088, 2020). In this way, the EU seeks to reorient capital flows towards sustainable activities and investments and directly involving the financial sector.

Indeed, the financial sector has a pivotal role in facilitating the transition to a CE by providing financing to CE projects and proactive companies. Furthermore, the new standards adopted to inform about the sustainability characteristics of investment funds point out at the relevant role that the financial sector may play as 'adviser' for investors and other stakeholders. On the other hand, this sector is also committed to adopt the CE and sustainability perspective in their own premises. As pointed out by Marco-Fondevila et al. (2021), the financial services sector reporting (mostly composed of commercial banks in the study), shows a strong commitment with sustainability, especially with regards to renewable energy, energy efficiency and low carbon emissions, as well as to low environmental impact and dematerialization. However, given the type of activity associated to the banking business, their indicators are mostly focused on energy consumption in their premises, use of paper, ink and other materials, and fostering environmental activities.

The financial sector contribution to the CE may well go beyond the initiatives adopted within their premises and the financing of CE projects (Aranda-Usón et al., 2019; Scarpellini et al., 2021). Specifically, some financial instruments offered by the sector, such as leasing and renting contracts, may be connected to indirect improvements in areas like carbon emissions, energy efficiency and renewable energy (Scarpellini et al., 2021). In 2018, Ionacu & Ionacu (2018) found that leasing and renting contracts act as a catalyst for companies' financial performance. Analysing a sample of quoted companies over a 4-year period, the authors concluded that leasing does not penalise the economic performance but allows for their sustainable development. According to Fischer et al. (2012) vision of the "leasing society", leasing transactions are connected to circular business

models since the asset is recovered by the leasing company at the end of the lease or the asset lifetime, reintegrating it into a new economic cycle with a minimal impact on the natural environment.

From that standpoint, and focusing on the leasing and renting contracts applied to vehicles, a shift from private ownership to a leasing/renting option, may bring a lower need of vehicles and a more efficient use of the latter. In this sense, the financial sector, as main actor in offering and providing leasing and renting contracts to companies, could be having a significant indirect role in facilitating the transition to a CE model. However, to the best of our knowledge, no research has been conducted to assess the actual link that leasing and renting contracts may have with the circular model and the related impacts in terms of CE. Therefore, the first research question (RQ1) of this paper aims at contributing to that gap in the literature.

Previous research on the topics of CE and the banking sector does not address the leasing and renting contracts as a lever to promote the CE. Indeed, according to Benito-Bentué et al. (2022) results, financial entities managers are not aware of the potential impact of such financial instruments, and focus solely on the CE initiatives applied within their companies and on the CE projects they do finance. However, by being aware of that impact, measuring it and reporting about it, both, financial institutions and stakeholders would be capable of acknowledging its potential and adopt it as part of their sustainability behaviour. Therefore, it becomes necessary to assess in which way does the shift to leasing and renting contracts contribute to the extension of the CE model, and which indicators could be used to report about it. Consequently, our second research question (RQ2) addresses this line of inquiry.

In order to reach a valuable and reliable answer to these questions, it is necessary to analyse a large sample of leasing and renting contracts, as well as the details and implications linked to the CE. To reach that goal, the current research is based on a case study in a banking entity, analysing its renting contracts for vehicles during an 18-year period.

From a theoretical perspective, our research provides the first comprehensive and up-to-date analysis of previous studies focused on the CE in the banking sector. We approach existing financial instruments such as renting from an unprecedented perspective, applied to the CE-related measurement. In addition, we summarise the current state of knowledge to describe the stream of research by offering structured indicators and a specific measurement procedure for environmental accounting.

In summary, the main objective of this study is to broaden the knowledge about the potential of existing financing instruments to extend the circular model in the framework of environmental accounting. It is, therefore, focused on providing the specific metrics to measure the renting contracts impact upon the CE, and allow for extended reporting from the financial sector.

2. Background

2.1. The CE in the banking sector

Financial institutions have a key role to play in reshaping economies, enabling the introduction of CE through the financing of models that incorporate circularity to generate opportunities in the financial sector (Moneva et al., 2023). The EU expects financial institutions to develop products and services that respond to the different needs of companies

Table 1. Summarised classification of main CE-related literature considered as the basis for this study

CE-related concept	A general approach to the CE considered for banking sector analysis is based on concepts such as reuse, recycling, eco-innovation, resource efficiency, waste elimination, and regenerative design.	(Cole, 2011; Johl & Toha, 2021; Kirchherr et al., 2017; Salesa et al., 2022; Stahel, 2016; Tisserant et al., 2017; Worldwathc Institute, 2008; Xiang et al., 2020)
Sectorial applied approach	Circular applied proposals are considered for adapting different sectors to the CE, such as Agriculture, Construction, Energy, Real Estate or banking sector.	(Gubeladze & Pavliashvili, 2020; Hao et al., 2020; Ikiz Kaya et al., 2021; Norouzi et al., 2021; Salesa et al., 2023)
Business model	The CE enables the evolution from traditional business models to circular business models, thereby overcoming barriers and taking advantage of opportunities through improved competitiveness, cost savings, or transformation to circular value chains, including in the banking sector.	(Li et al., 2010; Mentink, 2014; Ormazabal et al., 2018; Roos & Brackley, 2012; Salvioni & Brondoni, 2020)
Banking sector	Financial resources and financing of the CE have been analyzed in terms of public and private funds, requiring the need to adapt current financing models in the banking sector because it offers benefits such as loan diversification, promoting responsible and sustainable banking, and increasing the number of circular and sustainable customers.	(Aranda-Usón et al., 2019; Ozili, 2021; Ozili & Opene, 2021; Saarinen & Aarikka-Stenroos, 2022b; Toxopeus et al., 2018; Ziolo et al., 2020)
Theoretical approach	Financial institutions are including the CE-related indicators to report their environmental activities to increase their legitimacy. The theoretical approach to this specific topic is still understudied.	(Benito-Bentué et al., 2022; Llana-Macarulla et al., 2023; Moneva et al., 2023)

looking to develop circular business models that accelerate the transition. In fact, pressure from governments, institutions and other stakeholders' groups is pushing large financial sector corporations to increasingly disclose non-financial information (Elalfy & Weber, 2019; Aguado-Correa et al., 2023). Under the general framework of the stakeholders' theory, this study analyses how the sector can respond to the stakeholders' pressure about the challenges posed by the EU sustainable finance taxonomy in terms of promoting environmental change within the framework of sustainability reporting. However, the theoretical framework of analysis for the measurement and reporting of the CE is still unclear (Aranda-Usón et al., 2022). To fill this gap, the main goal of this section is to define a framework of analysis to connect the implications of the CE for financial institutions within environmental accounting and reporting.

The adaptation to the CE presents benefits for commercial banks and other financial institutions showing greater opportunities in diversification in loans, in growth of financing to new circular customers and in the improvement of social perception towards the financial sector promoting responsible and sustainable banking (Ozili, 2021). In this way, financial institutions can accelerate the financing of the low-carbon economy through project financing, prices of emissions-linked products or expanding the range of products in their portfolios.

One of the objectives to address is how the CE is financed through the financial sector. Analysing the accessibility to financing innovative business models based on circularity, Saarinen & Aarikka-Stenroos (2022) analyse the factors that can drive funding to the Circular Economy by observing that applying criteria such as profitability, valuation, and investment costs in circular business models is a viable measure for financing, and therefore they conclude that financial entities should update their financing analysis approach.

Given these considerations, it is interesting to know which opportunities for the financial sector may come from financing circularity, in a way that allows for a faster transition to the CE through the allocation of capital, the servitization of the economy and the development of rules that guide financial activity to contribute for a sustainable growth model.

Indeed, the financial sector is still not identified as a financier of the CE, and banking is referred to under terms such as "Green Banking" (Chen et al., 2022), as a crucial sector to promote "Socially Responsible Investment" (da Silva Inácio & Delai, 2022), and as "Ethical Banking" (Oh et al., 2013), but without relating it to the CE or product servitization. Therefore, the importance of analysing the current products that

the banking sector is offering lies on the possible adaptations that they are suffering in order to meet the expectations of integration and adaptation towards the sustainability of the sector, being able to present characteristics that enhance or can be related to the CE.

The adaptation of these financial products to sustainable finance through the use of cash flows has caused limitations when promoting circularity, restraining the analysis of the role of the sector in a CE scenario (Dewick et al., 2020; Ozili & Opene, 2021). Consequently, one of the financial products where possible characteristics related to CE could be present are the leasing and renting contracts, which purpose is to finance an asset and not the cash flow.

From a theoretical perspective, we could argue that the literature tends to associate the concept of CE with corporate environmental management in line with results obtained by Heras-Saizarbitoria et al. (2023) at micro level, being particularly relevant the reporting activity (Moneva et al., 2023). Thus, according to Moneva & Llana, (2000), the stakeholder theory is of interest in this study because it recognises that, besides the traditional users of accounting information (shareholders and creditors), several additional agents are interested in the environmental behaviour of companies through CE reporting. Consequently, financial institutions are including the CE-related indicators to report their environmental activities to increase their legitimacy. The visibility of financial products backed by socially and environmentally responsible investments through the common EU taxonomy label responds to various stakeholders' interests and is causing an increase of CE accountability in response of their stakeholders' interests (Moneva et al., 2023).

Form a different theoretical approach, other CE studies analyze accounting from perspectives inspired by the resource-based view theory (Llana-Macarulla et al., 2023) and by the evolution of dynamic capabilities (Scarpellini et al., 2020). In addition, Llana-Macarulla et al. (2023) apply the Institutional theory to study environmentThe European taxonomy of sustainable investments of the EU details the classification of activities that are considered CE to be included in the sustainable financing scheme of EU Regulation 2020/852 (Regulation (EU) 2020/852 on the Establishment of a Framework to Facilitate Sustainable Investment, and Amending Regulation (EU) 2019/2088, 2020), by promoting repair, reuse, reduction and recycling, among other priority issues for the material loops closing. Within this framework, products are called to finance new business models based on the sharing of goods that maximize their utility and the value of the product as long as possible. Thus, leasing and renting

can be considered as instruments that allow for compliance with environmental and carbon emissions limits, since, given their characteristics, they may finance circular goods such as vehicles, for instance. As stated by (Rogers & Rodrigues, 2015), long-term leasing of cars benefits both the supplier and the customer from a sustainable development point of view. Focusing on carbon emissions, the authors associate the leasing and renting contracts to a longer life of the asset, thus to lower emissions linked to the primary production and manufacturing of vehicles.

On the other hand, leasing and renting contracts relate to circularity through services such as maintenance or repair, cost savings compared to private property or access to different vehicles, encouraging the use of increasingly lesser polluting technologies. In summary, it can be argued that this type of financial instrument facilitates the paradigm shift to decouple the use of property including in the change of consumer-object behavior and relations between consumers (Bardhi & Eckhardt, 2012).

In general terms, servitization allows the manufacturer to retain ownership of the product (Windahl & Lakemond, 2010) or dispose of it to a financial institution, allowing the customer to use it through leasing and renting contracts. Therefore, the analysis of vehicle leasing and renting as a lever for behaviors linked to circular models is of interest since it encourages a greater intensity of use with respect to owned vehicles (Ellen MacArthur Foundation, 2015) while it improves efficiency (Korhonen, Honkasalo, et al., 2018; Korhonen, Nuur, et al., 2018). Renting being an alternative to the ownership of private vehicles when another type of transport is not possible or convenient (Katzev, 2003), it allows the manufacturer to retain ownership of the product (Windahl & Lakemond, 2010), and it favors a reduction in number of cars being able to replace one car-sharing vehicle by 6.5 owned vehicles (Millard-Ball et al., 2005). Regardless of its greater or lesser use, the reuse of the vehicle in renting would enhance the circularity of the vehicle by increasing its use and therefore its longevity (Franklin-Johnson et al., 2016).

However, to the best of our knowledge, no study has been published that quantitatively studies the actual impact of renting contracts in relation to circularity, with specific indicators in terms of carbon emissions reduction, use of resources or reduction of waste for reporting in a CE-related model. Thus, the first research question of this study is the following (RQ1): *Is the shift to leasing/renting contracts positively related to the CE model?*

We approach these topics from the accounting and reporting perspective (Burritt & Schaltegger, 2010; Larrinaga & Bebbington, 2021; Schaltegger et al., 2006; Unerman et al., 2010) and taking into account the stakeholders' theoretical framework that is still understudied in the framework of the CE (Salesa et al., 2023). Only few studies have explicitly analyzed financial institutions' impacts on the CE and sustainability, and its reporting (Bonifácio Neto & Branco, 2019).

This study addresses this gap, by empirically analysing the effects that renting contracts may have in promoting the CE, specifically in renting of vehicles, since they represent the highest share of renting contracts, and are subject to significant environmental impacts. Through this analysis, we intend to answer the following research question (RQ2): *Which indicators could be used to report on the leasing/renting impact as CE-related contracts?* al accounting practices related to the CE because they consider that regulations and operations developed in a circular model could partially explain the implementation of measuring practices and the reporting in a

circular scenario in line with (Marco-Fondevila et al., 2020). However, based on the few specific studies in the banking sector and the main objective of this research, we consider the general framework of the stakeholders theory as a reference for our research, still aware that it requires significant future research.

2.2. Leasing and renting contracts in a circular model

The European taxonomy of sustainable investments of the EU details the classification of activities that are considered CE to be included in the sustainable financing scheme of EU Regulation 2020/852 (Regulation (EU) 2020/852 on the Establishment of a Framework to Facilitate Sustainable Investment, and Amending Regulation (EU) 2019/2088, 2020), by promoting repair, reuse, reduction and recycling, among other priority issues for the material loops closing. Within this framework, products are called to finance new business models based on the sharing of goods that maximize their utility and the value of the product as long as possible. Thus, leasing and renting can be considered as instruments that allow for compliance with environmental and carbon emissions limits, since, given their characteristics, they may finance circular goods such as vehicles, for instance. As stated by (Rogers & Rodrigues, 2015), long-term leasing of cars benefits both the supplier and the customer from a sustainable development point of view. Focusing on carbon emissions, the authors associate the leasing and renting contracts to a longer life of the asset, thus to lower emissions linked to the primary production and manufacturing of vehicles.

On the other hand, leasing and renting contracts relate to circularity through services such as maintenance or repair, cost savings compared to private property or access to different vehicles, encouraging the use of increasingly lesser polluting technologies. In summary, it can be argued that this type of financial instrument facilitates the paradigm shift to decouple the use of property including in the change of consumer-object behavior and relations between consumers (Bardhi & Eckhardt, 2012).

In general terms, servitization allows the manufacturer to retain ownership of the product (Windahl & Lakemond, 2010) or dispose of it to a financial institution, allowing the customer to use it through leasing and renting contracts. Therefore, the analysis of vehicle leasing and renting as a lever for behaviors linked to circular models is of interest since it encourages a greater intensity of use with respect to owned vehicles (Ellen MacArthur Foundation, 2015) while it improves efficiency (Korhonen, Honkasalo, et al., 2018; Korhonen, Nuur, et al., 2018). Renting being an alternative to the ownership of private vehicles when another type of transport is not possible or convenient (Katzev, 2003), it allows the manufacturer to retain ownership of the product (Windahl & Lakemond, 2010), and it favors a reduction in number of cars being able to replace one car-sharing vehicle by 6.5 owned vehicles (Millard-Ball et al., 2005). Regardless of its greater or lesser use, the reuse of the vehicle in renting would enhance the circularity of the vehicle by increasing its use and therefore its longevity (Franklin-Johnson et al., 2016).

However, to the best of our knowledge, no study has been published that quantitatively studies the actual impact of renting contracts in relation to circularity, with specific indicators in terms of carbon emissions reduction, use of resources or reduction of waste for reporting in a CE-related model. Thus, the first research question of this study is the following (RQ1): *Is the shift to leasing/renting contracts pos-*

itively related to the CE model?

We approach these topics from the accounting and reporting perspective (Burritt & Schaltegger, 2010; Larrinaga & Bebbington, 2021; Schaltegger et al., 2006; Unerman et al., 2010) and taking into account the stakeholders' theoretical framework that is still understudied in the framework of the CE (Salesa et al., 2023). Only few studies have explicitly analyzed financial institutions' impacts on the CE and sustainability, and its reporting (Bonifácio Neto & Branco, 2019).

This study addresses this gap, by empirically analysing the effects that renting contracts may have in promoting the CE, specifically in renting of vehicles, since they represent the highest share of renting contracts, and are subject to significant environmental impacts. Through this analysis, we intend to answer the following research question (RQ2): *Which indicators could be used to report on the leasing/renting impact as CE-related contracts?*

3. Method and case study

The study of the effect that financial instruments such as renting may have in the promotion of the CE requires an in-depth analysis of those instruments' details, beneficiaries, characteristics, etc. Therefore, a case study method was chosen as the best option to extract very specific data from a particular entity representing the sector, from which conclusions may be extrapolated to the whole of the sector. The main phases of the analysis are summarised as follows:

- Literature review and selection of financial instruments to analyse
- Case study selection and empirical data collection
- Preparation of the multi-annual data bank
- Data analysis and main results

The entity selected is a Spanish banking group with more than 5,000 employees in which one of the financial instruments offered is renting. In fact, it is a product which turnover has been increasing through the years, evidencing a growing demand for this type of products by the market. The renting contracts offered are mostly oriented to vehicles. Within the company strategy, sustainable and circular products, as well as their financing, are not key elements, so the data extracted for the sample do not have any type of sustainable characteristic a priori, thus being representative of the standard practice in the sector.

The choice of this particular entity was determined by the possibility to access the necessary data to carry out the research, which allowed us to draw conclusions based on real events. To this end, the necessary variables were extracted from the renting contracts, grouping them by type of vehicle, mileage and contracted time horizon. Information and data limitations were then assessed. Once these limitations were solved, the data were brought to a quantitative analysis through arithmetic calculations, means and weightings that would allow us to know the evolution of these instruments through the historical series, and their impact in CE.

3.1. Renting data analysis

In order to know if renting contracts are a financial product impacting the CE, a quantitative methodology has been used, so that real data was obtained, allowing us to measure the potential impact on CE of such financial instruments. To that

end, the scope of the research was defined as all renting contracts for an 18-years period, from 2004 to 2021. The variables extracted from the contracts are those shown in Table 2.

Table 2. Renting contract variables analysed

Variable	Data
Total mileage in contract	Total mileage contracted per time horizon
Time horizon	Contract length in time
Client type	Company or individual
Vehicle model	Classification per model
Plate	Environmental classification
Investment	Amount paid in acquisition
Discount	Discount given by supplier
Residual value	Final value of the vehicle at the end of its life

For each contract, the annual mileage of the vehicle was calculated, taking into account the number of kilometres contracted and the time horizon, thus obtaining the average number of kilometres per vehicle and per type of contract.

$$\frac{\text{Total Kilometres}_n}{\text{Nbr. of vehicles}_n}$$

Secondly, through their registration data, the environmental labels of vehicles in the fleet were noted so that the energy rating of the vehicle was determined, that is, the quality in terms of CO₂ emissions. The classification of the label, from highest to lowest number of emissions made by vehicles, was obtained from the database of the General Directorate of Traffic. Then, for each year of the historical series, the vehicles that existed for each environmental label were quantified calculating the average on the total number of vehicles per year. In this way, for each year of the historical series, the composition in terms of environmental quality contracted, out of the total contracts for each year, was available.

3.2. Impact on CE

Firstly, we analysed renting contracts from a socio-economic perspective, by carrying out several analyses, starting with the historical evolution of mileage contracted through the years, to assess if more mileage is demanded by consumers and therefore a more intense use of the vehicle is made through renting compared to the use of private ownership vehicles. On the other hand, a longer time horizon of renting, implies a greater number of kilometres contracted for the vehicle and therefore a longer use. The classification obtained for number of kilometres and time horizon per vehicle in renting contracts is then compared to the average kilometres per year in the whole country, as disclosed by the Traffic General Directorate in Spain¹.

Secondly, from the investment point of view, another of the renting contracts characteristics is that it gives access to newer vehicles, thus counting on more efficient technologies with lower CO₂ emissions rates. However, these vehicles tend to have higher prices which may discourage private users to choose them as the preferred option. In renting contracts, it is the financial entity who assumes the cost of the vehicle, with access to discounted prices, on the one hand, and distributing the extra cost through several years of renting contract, on the other. In this sense, the information about the vehicle price, the discount given to the entity and its residual value have been extracted from the renting contracts, so that the

¹Study by the General Directorate of Traffic in which they analyse the data of 26,402,304 vehicles analysed in Technical Inspection of Vehicles service (ITV).

investment assumed by the company can be compared to that of a private owner. In order to discriminate among renting contract users being individuals or companies, the taxation effect was included in the analysis.

Thirdly, from the environmental point of view, the fact that renting contracts give access to newer and less polluting vehicles does also have an effect on the carbon emissions of the fleet. Therefore, the renting contracts of the entity were grouped according to their environmental label and carbon emissions rate, so that they can be compared to the corresponding averages of the whole country fleet of vehicles. To that end, the research used the data provided by the Spanish Institute for Energy Saving and Diversification (IDAE)², where the average carbon emissions for renting vehicles and the whole fleet can be extracted. In order to establish a comparable data set, the length of renting contracts was homogenised to fit the period presented by the study. Therefore, we used the total number of monthly kilometres contracted for each year by time horizon, so that the emissions for each year were applied to each vehicle, showing the evolution of emissions as of entries and exits of vehicles from the fleet. The annual mileage of the fleet was multiplied by the average grams of CO₂/km generated by the vehicle according to the study.

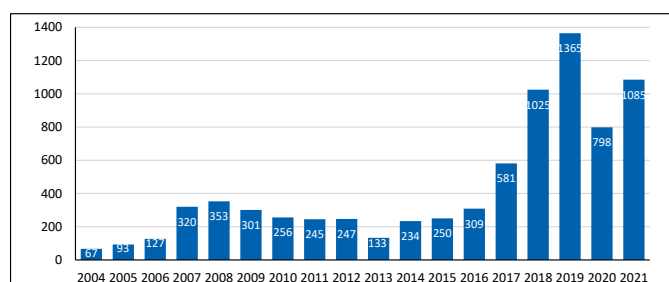
$$Emissions_t = \sum_t m * (g CO_2 * Km_t)$$

With m = months of CO₂ emissions in year t and t = every one of the analysed years in the study.

4. Main results

The first approach to the renting contracts evolution in the entity over the period studied showed a significant increase in number of contracts and mileage, with a sudden change of trend in 2020 that bounds back in 2021, likely due to the COVID-19 pandemics impact in the economy (Figure 1). This first observation suggests that the potential impact of renting contracts on CE is growing as a result of its scale and the number of kilometres contracted.

Figure 1. Number of renting contracts per year



Secondly, the data show that over the years, and specially from 2015 onwards, the preferred time horizon for renting contracts becomes longer than before, meaning more years of use and more kilometres per renting contract and vehicle (Figure 2).

Indeed, as shown in Figure 3, the average use of vehicles in kilometres per year increases as the contracting period grows, with 5-year time horizon contracts as those with higher average mileage per year.

²Published in 2019, with data for consumption and carbon emissions of renting vehicles in 2018.

Figure 2. Number of vehicles contracted per time horizon and year

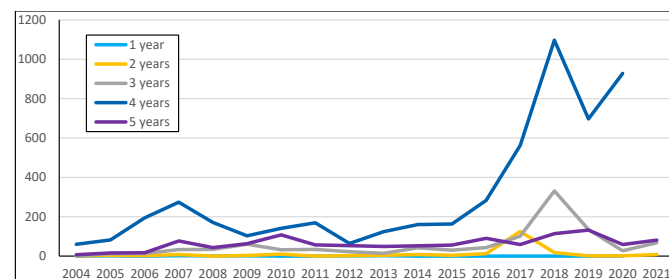
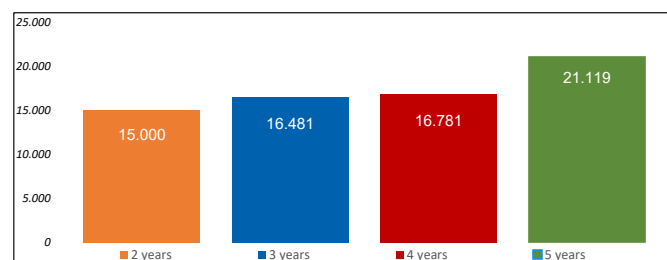
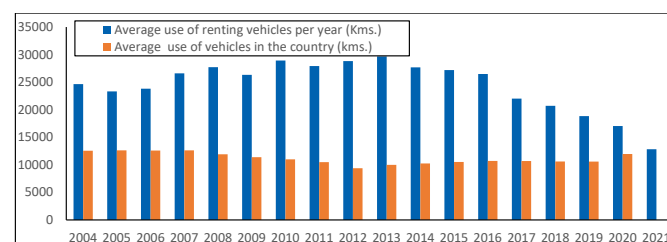


Figure 3. Average use of vehicles per renting time horizon (kms.)



If compared to the national average of kilometres per vehicle in Spain, it can be seen how the average number of kilometres for renting contracts is typically higher than the national average, even though the difference has decreased over the last few years (Figure 4).

Figure 4. Average use of vehicles (kms.)



The second part of the renting contracts analysis was driven to its potential to foster the access to newer and less polluting vehicles. As previously explained, renting contracts may allow to better financial conditions and significant discounts on price, which facilitate the access to new technologies at more affordable costs. In this respect, we focused the analysis in 'zero emissions' vehicles, which represent the more sustainable kind in terms of carbon emissions.

The analysis was carried out in gross for legal entities, and in net for individuals. First, the main difference between the two analyses lays in the investment made by the client (Table 3). We can observe that the investment assumed is lower in legal entities because taxes can be deducted, whereas individuals cannot. On the other hand, the bank obtained almost a 15% discount on vehicles with a 'zero emissions' label, which meant that, while a private individual (not a client) had to acquire a vehicle at 100% of its cost, the bank was able to acquire it at 87.27%. Considering that the residual value of the vehicle was calculated by the bank to be 40.73% of the vehicle initial value, the investment that the clients had to make was 46.54% of the vehicle cost if they were legal entities and 56.32% if individuals.

If the client acquired the vehicle in ownership instead of accessing to its use through renting, the price to pay for it be-

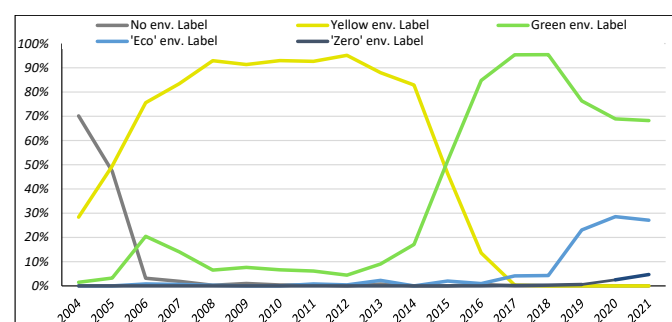
Table 3. Blue label vehicles financing access

	Legal entities	Individuals
Discount	14,79%	
Company investment	87,27%	
Residual value	40,73%	
Client investment	46,54%	56,32%
Difference between ownership and renting	114,86%	77,56%

comes more than double for legal entities and around 77% higher for individuals. On top of this, expenses such as insurance or repairs, which were not taken into account in the analysis, are higher with ownership since in renting contracts the insurance deal negotiated between supplier and company is typically better than for private owners, and repairs are assumed by the company and not by the client (unlike with private owners).

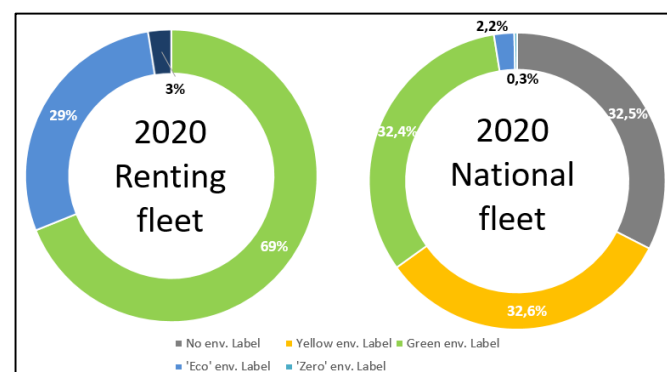
According to the reports of the European Automobile Manufacturers Association³, cars in Spain have an average age of 12.9 years. If the difference between ownership and access to the vehicle in legal entities and individuals was of 114.86% and 77.56% respectively, with an investment of 46.54% and 56.32%, and considering an average time horizon for renting contracts of 4 years, we could envisage that in 12.9 years, renting would foster three 'zero emissions' vehicles compared to just one in private ownership.

The third step of the analysis addresses the environmental perspective by assessing the evolution of the environmental characteristics of the renting fleet vehicles through the analysis of its energy efficiency according to the different labels given by the authorities (Figure 5).

Figure 5. Environmental label of the renting fleet

Firstly, it can be observed how in 2004 more than 70% of the total renting fleet was composed of vehicles without label, that is, the fleet was mostly composed of vehicles of the worst environmental quality. From 2004 onwards, most of the fleet improved from 'no label' to 'yellow label', the second worse, while the most environmentally wise types remained below 10% of the total fleet. Again, a sudden change of trend is visible from 2012 onwards, substituting the 'Yellow label' by the more efficient 'Green label', while from 2016, a significant surge of the 'Eco label' type can be also noted. By 2020, the energy efficiency of the vehicles in the renting fleet was composed of almost one third of 'Eco' or 'Zero' emissions vehicles and a bit more than two thirds of 'Green label' vehicles. In contrast, the whole fleet in the country is still composed of one third of vehicles with 'Yellow label', another third with no label at all, and just one third for 'Green Label' vehicles (Figure 6).

³The Automobile Industry Pocket Guide of 2020-2021. https://www.acea.be/uploads/publications/ACEA_Pocket_Guide_2020-2021.pdf (accessed in January 2023)

Figure 6. Energy efficiency in the renting and national fleets

Even though since 2020 the trend presents a slight deceleration, possibly due to the effect of COVID-19 in households and companies' availability of funds together with the current crisis in the vehicles manufacturing sector, it is clear that the renting fleet is far more efficient than the national one, contributing to less polluting cars and lower carbon emissions.

Indeed, looking specifically to carbon emissions, beyond the significant gap in volume of emissions derived from the different environmental structure of the renting fleet and the national one, it has to be noted that the trend continues and gets wider, when comparing the new vehicles registered every year. As shown in Table 4, the difference in average carbon emissions from newly registered cars for renting and for private owners, grows since 2012, being of almost 4% less emissions in year 2021.

Table 4. Trend in carbon emissions for new registered vehicles

Year	Renting contracts	Private Ownership	Difference
2012	133,94	136,08	-1,57%
2013	125,87	127,95	-1,59%
2014	121,46	123,98	-1,75%
2015	117,69	120,8	-2,00%
2016	114,56	118,93	-2,63%
2017	114,46	119,09	-3,27%
2018	117,36	122,25	-3,74%
2019	120,21	125,07	-3,89%
2020	112,29	115,95	-3,79%
2021	128,89	133,67	-3,71%

The results reflect an increase in absolute emissions from renting contracts due to the significant increase in the number of vehicles in the fleet. However, when looking at emissions per vehicle, the average emissions from vehicles in the renting fleet has steadily become smaller, at a higher pace than private ownership vehicles.

4.1. Reporting issues and discussion from an accounting perspective

The analyses performed in the chosen entity for an 18-year period, breaking down the renting contracts information to get relevant details about its potential indirect impact in promoting the CE, has rendered relevant results. As an alternative to private ownership, the renting contracts for vehicles have proven to have a positive effect in reducing the total number of cars needed. Thus, these financial instruments are related to various CE's principles, like dematerialization, emission saving, sharing goods and servitization.

As detailed in the previous section, the renting fleet of vehicles accumulate a higher number of kilometers per year,

namely a higher mileage, than those of private ownership. If we assume the number of kilometers to undergo by users does not depend on the ownership option, but on labor or domestic conditions, it becomes clear than for a given number of kilometers, the renting option requires a lower number of vehicles and, thus, a lower use of resources. Consequently, it implies higher intensity levels in the using phase.

The discounts and special conditions that renting entities such as the studied can get from suppliers, have also an impact in easing the access to more environmentally wise vehicles. Indeed, newer technologies such as the ‘zero emissions’ vehicles, imply higher selling prices which may limit the companies and private users’ potential to choose this option. Our results show how the intermediary role of renting entities may allow to a much lower investment from legal entities and individuals, thus favoring the expansion of less polluting vehicles.

On the other hand, and specially in countries such as Spain, which vehicles fleet is rather old and energy inefficient, the renting contracts favor the substitution of obsolete cars for new ones with better environmental characteristics. Indeed, our results highlight the fact that the distribution of the different environmental labels is much cleaner among the renting fleet of cars than among the national fleet. Even when new registered vehicles are compared in terms of carbon emissions, those to serve renting contracts have better ratios than those of private ownership, stressing the higher obligation of renting entities towards environmentally clean vehicles.

As a consequence, we may answer the first research question (RQ1) by acknowledging the positive impact that renting contracts have in fostering the CE in key areas such as reducing the need for resources, improving the energy efficiency and reducing the carbon emissions.

It is important to note, however, that our study has not reached a clear understanding of what the end of live cycle is for renting vehicles. Once discarded for renting service, we have managed to find out the residual value of the vehicles, as calculated by the entity, but we are not certain about the destination or use of those vehicles from then on, all of which could have relevant implications in terms of its positive or negative contribution to circularity.

The important role of commercial banks and financial institutions to foster the CE has been widely described by scholars and institutions such as the EU, mostly as intermediaries that provide financing to circular companies and projects. Furthermore, commercial banks are increasingly interested in adopting sustainability and CE initiatives (Benito-Bentué et al., 2022). However, managers and decision makers in these entities are not aware of the inherent potential that some financial services they provide to their clients may have to extend the circular model. Just by acknowledging and envisaging this potential, financial entities could develop metrics and indicators to measure and disclose their indirect impact in CE.

Our results show that renting contracts have a significant impact in terms of use of resources (both for number of vehicles and energy consumption), in environmental impact and in carbon emissions avoided. This information is definitely relevant for the entities, since it brings a new perspective to the renting business, with non-financial benefits and sustainability related goals. Indeed, this new understanding of the renting business impact in CE may change the financial entities’ approach to it, making it a corporate strategic service, built upon both, the financial and the non-financial goals of the entity. Therefore, it is of the entities’ interest to understand, measure and report their renting contracts im-

pact in CE as an environmental accounting procedure, and as part of the environmental related disclosure (Blanco-Zaitegi et al., 2022; Llana et al., 2007; Schaltegger et al., 2017).

On the other side, a number of reasons suggest that reporting on the mentioned impacts, both qualitatively and quantitatively, may be also beneficial for the entities’ customers, their stakeholders and society as a whole. For a company contracting renting services from financial entities, it is clearly interesting to know the environmental benefits attached to the service since they contribute to its own commitment to the CE. Furthermore, such information becomes another positive point towards shifting to the renting model, thus contributing to more business for the financial entity, and a more sustainable fleet of vehicles. Beyond the focus on the entity and its clients, as well as on its reputation and corporate image, reporting on the positive impacts of renting does also help extend CE initiatives such as car-sharing, car-pooling and similar ideas in the framework of servitization of the economy. Indeed, the financial entities’ stakeholders are very diverse and numerous, and most of them could be interested in knowing about the particular contribution of the financial sector through renting contracts to the CE.

Therefore, besides developing specific metrics and internal systems to measure the renting contract impact, financial institutions should consider including this information in their reports in response to the increasing stakeholders’ interest in the CE. To that end, together with the qualitative information, some specific quantitative indicators could be included in the corporate reports. Answering the second research question (RQ2) and based in our results, the following table presents some of the indicators that the entity could use to report on their impact on CE linked to their renting contracts (Table 5).

Table 5. CE indicators from renting contracts

Sustainable use of resources	Average mileage of renting cars compared to national fleet	• Km/car per year or Km/vehicle through its live cycle
Environmental impact	Energy efficiency label distribution compared to national fleet	• Percentage of Yellow, Green, Blue and Zero labels
	Percentage of zero emissions vehicles in the fleet	• Percentage of Zero emissions vehicles in the fleet and percentage compared to national fleet
Fight against Climate Change	Carbon emissions avoided per Km. compared to national fleet	• CO ₂ gr./Km. renting vs. CO ₂ gr./ Km national fleet
	Evolution of carbon emissions within the renting fleet	• CO ₂ gr./Km per year

The indicators presented in Table 5 are examples (among other) derived from the results obtained in our study, which could be adapted to the entities’ strategy, policies and needs. Besides, these indicators are connected to existing standards and initiatives such as the GRI, for energy intensity and efficiency, or the Green House Gas protocol (GHG), with its three scopes for carbon emissions.

Specifically, the GRI 305 series of indicators for emissions, includes three indicators for energy use (one per scope as of GHG protocol), and one for energy intensity. Although the indicators we propose in this paper would not make part of GRI 305 Emissions indicators due to the different focus, the entities could present specific indicators as suggested in Table 5 following the same scheme of GRI 305, thus associating the volume of carbon emissions saved through more mileage per car, more efficiency in use and more carbon free vehicles, to the standard scheme. The indicators proposed could then serve as complementary information to GRI 305.

Despite some voices questioning the CE relevance in the accounting field at the moment (Larrinaga & Garcia-Torea, 2022), this study highlights the pivotal role of existing financial instruments, as renting and leasing, for new measurements of car-sharing and car-pooling impacts linked to the servitization of the economy as specific issues in the framework of the so-called circular sustainability accounting (Aranda-Usón et al., 2022; Scarpellini, 2022).

5. Conclusions

The CE has become a main objective for institutions and companies willing to fight critical issues such as global warming, environmental degradation and scarcity of resources. The role of commercial banks and financial institutions has been described as crucial, since they are a key actor to finance companies and projects. However, the current involvement of the financial sector is apparently limited to financing others and implementing small actions within their premises.

By studying the details of renting contracts over an 18-year period, this study enhances the knowledge about how existing financial instruments such as renting and leasing may offer a link to extending the CE-related actions reported by commercial banks and financial institutions. Particularly, the renting contracts service, which has been associated to more sustainable performance, shows interesting characteristics linked to the CE principles. Indeed, the quantitative results obtained prove the facilitating role that the financial sector has to extend the CE model through the renting business.

In this respect, measuring the quantitative impacts and reporting about them is equally important on an environmental accounting basis and in the framework of the new EU taxonomy for 'green' products and services. Understanding and acknowledging the potential of renting contracts to extend the CE, becomes important not only for financial entities, but also for their stakeholders, who may decide to shift from ownership to renting if they know about its impact on CE. The inclusion of specific indicators for renting contracts impact on CE serves both, the instrumental perspective of reporting (by improving commercial banks and clients' business and corporate image), and the normative one, by extending relevant information on sustainability among stakeholders.

In this regard, and despite the existing debate over the theoretical framework for the CE (Aranda-Usón et al., 2022), the role and involvement of the banking sector could be seen from three different theoretical perspectives. Looking at the improvement of reputation derived from reporting on CE contributions, the legitimacy approach could be guiding the entities. On the other side, the savings in use of resources, carbon emissions and environmental impact could also be associated to the Resources Based View theory. However, the fact that these improvements serve society as a whole, and that reporting over it may have an impact on stakeholders' behavior, suggests a normative approach that would fall under the stakeholders' theory framework.

This paper contributes to the literature on CE by bringing empirical results to a still recent line of research such as the actual role of the banking sector. Our results do also help practitioners, mostly within the banking sector, understand the potential to foster the CE and align to sustainability goals. Finally, by highlighting the wider role of financial institutions in promoting the CE, our work may be of use for policymakers who can consider to make them part of future strategies and policies on the matter, as well to society as a whole, since it gains a possibility to engage in a more sustainable behavior

by shifting to renting based schemes such as sharing economy, servitization or a more rational and efficient use of vehicles.

Even though the research was based in a rather long period, the fact that only one entity was studied can be considered as a limitation. The selected entity is representative of the Spanish sector, and has an average volume of business in what regards renting contracts. However, extending the study to other entities, especially in other countries, could improve and extend the use of results. On the technical side, more information would be relevant to close the loop, especially regarding the end of life of vehicles. To that end, this line of research could be extended by applying the Life Cycle Analysis and Life Cycle Costing methods to the renting contracts analysis.

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Conflict of interests

The authors declare no conflict of interests.

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4. Capítulo cuarto. Desarrollo e integración de economía circular y riesgos climáticos y sociales en la inversión y su financiación

4.1 Integración de riesgos climáticos y economía circular

El cuarto capítulo de la Tesis, desarrollado en el tercer estudio de la misma, se encuentra actualmente en revisión (*major revision*) en la revista *Green Finance Review*: Benito Bentué, D., Marco-Fondevila, M., & Scarpellini, S. *Integration of climate and social risks in investment: an analysis of indicators on the principal adverse impacts for sustainability*. A continuación, se incluye la última versión en revisión.

Climate and social risks management in investments: an analysis of indicators on the principal adverse impacts for sustainability

The increasing regulation on sustainability disclosure in the European Union entails that financial market participants must work on greater transparency and disclosure of sustainable information. Studying a sample of the highest total assets funds managers in 2022, this research shows that half of the financial instruments are classified as sustainable, although the incipient stage of the European Union Taxonomy for sustainable investments implementation. Even though a high percentage of financial instruments have considered the regulation requirements to measure and report principal adverse impacts, specific indicators are heterogenic, insufficient and far from exhaustive, hindering comparability and credibility. This study contributes to the academic literature by providing significant empirical results to increase transparency about the financial sector's impact on sustainability. For practitioners, this study provides insight into which indicators or metrics are most commonly used to report principal adverse impacts, allowing for real comparability among products and well-informed decision-making by stakeholders. For policymakers, this research highlights the standards and indicators for financial institutions that need to be improved for reporting.

Keywords: Sustainable finance; Climate risks; Sustainability accounting; Sustainability management; Corporate finance; Financial sector

1. Introduction

The challenge of achieving a decarbonised economy makes it necessary for financial market participants to integrate sustainable practices into their investment and financing activities. Therefore, the advancement of sustainability regulation to avoid greenwashing (de Freitas Netto et al., 2020) requires increasing disclosure of information related to their financial products and services in a way that responds to how they are progressing in financing and investing in sustainability-aligned activities. Therefore, current products must be redesigned with sustainable features at a time when the development of EU regulation on sustainability is widespread, interactive, and

controversial (Ahlström & Monciardini, 2022). In face of such a challenge, integrating green finance into the banking system requires numerous institutional efforts and guidance (Chen et al., 2022).

On 10 March 2021, the EU Sustainable Finance Disclosure Regulation 2019/2088, known by its acronym SFDR, entered into force. Among the transparency and reporting obligations is the obligation to measure and disclose principal adverse impacts (PAIs), defined as those impacts of investment and advisory decisions that may have negative effects on sustainability factors. However, this regulation is not a clear tool for asset managers and investment funds, in the measurement of environmental and social impacts (Bengo et al., 2022). Furthermore, this regulation has meant that financial market participants have had to constantly adapt the categorisation of their investment products and the need to respond to how they are incorporating environmental, social, and labour issues, respect for human rights, anti-corruption, and anti-bribery in their investments (Cremasco & Boni, 2022).

Companies are required to report on how they integrate ESG factors into investment decision-making, and to provide information on the environmental and social impact of their investments, reporting through a set of standardised templates, which makes it easier for investors to compare different products. According to the Regulation, financial products fall into Article 6 products, i.e., financial products which do not have sustainability practices, into Article 8 products, i.e., products that promote, among others, environmental or social features or both; or into Article 9 products, i.e., products that aim to have a positive environmental or social impact. Three years later, how this categorization is being adopted by funds' managers is yet unknown, thus hindering its usefulness for stakeholders' decision-making.

However, one of the objectives of the Regulation is to understand how financial market

participants analyse the principal adverse impacts (PAIs) on sustainability factors, and, consequently, assessing and understanding the actual impact that EU Regulation 2019/2088 is having on the financial sector becomes imperative before enacting further regulations on the matter.

In addition, in June 2020 the EU published the Regulation (EU) 2020/852 of the European Parliament and the Council (EU Green Taxonomy), aiming to establish a standardised system for identifying environmentally sustainable economic activities and combating greenwashing. European financial institutions are required to measure and report on investments in economic activities that contribute to sustainability, and to disclose the extent to which their investments are aligned to the taxonomy. The ultimate goal being to provide investors with transparent information on the sustainability of their investments, it is necessary to assess the degree of alignment to the taxonomy that financial institutions are reporting in each of the financial instruments to know the stage of implementation and the efforts being made by the sector.

From a theoretical perspective, stakeholders' pressure for the financial sector to adopt a sustainable behaviour and to provide adequate representation of sustainability practices has resulted in non-financial disclosure taking on a crucial role in the European regulatory debate (Dmuchowski et al., 2023). Indeed, the right of stakeholders to take well-informed decisions grounded on the companies' reports is the basis for a normative focus (Deegan, 2009), but the prevalence of the voluntary/mandatory debate points at the institutional theory becoming the main framework to describe financial institutions' behaviour. If the increasing trend to include ESG factors in investment decisions responds to institutional pressure (Farooq & Maroun, 2017), the goal of providing the most useful and relevant information to the stakeholders may be at stake.

Assessing how regulations have been interiorized, and their impact since they entered into force becomes essential prior to any further institutional move, and sheds light on the actual drivers for financial institutions engagement with sustainability. The particular case of principal adverse impacts, offers the opportunity to analyse how financial institutions are responding to the new regulations and to what extent they are reporting sustainable information about their products. Indeed, by focusing on the assets managers degree of alignment with the EU Green Taxonomy, signals about the actual drivers for information, whether providing as much information as possible or purely complying with the SFDR rules, can be observed.

This paper delves into this important topic by analysing how the main assets managers in the world have adopted the Regulations requirements, the way in which they disclose information about the PAIs, and their reported alignment with the EU Green Taxonomy. By doing so, the paper contributes to explain the current status of sustainability reporting within the financial sector, the main drivers explaining the reporting approach, as well as the potential gaps that may be hindering the pursued goals.

2. Background

2.1 Asset management with ESG criteria

The financial sector has a key role to play through corporate finance and financial investments in the transition to a low-carbon economy (Bowman, 2010). The European Union, in its Action Plan: Financing Sustainable Growth (2018), sets out as a strategy for the transition to a green economy the need for the financial sector to integrate and embrace sustainable finance and investments (The European Parliament, 2020) with the aim of redirecting capital flows (European Commission, 2019). Therefore, the adaptation to undergo by the financial sector and investors requires that current products

must be redesigned with sustainable features at a time when the development of EU regulation on sustainability is widespread, interactive, and controversial (Ahlström & Monciardini, 2022). This adaptation implies numerous government measures with the aim of integrating green finance into the banking system as a new way to diversify the contribution to sustainable development (Chen et al., 2022).

Investors have adapted to sustainability by evolving their conventional investment strategies to those with ESG criteria. This has led to significant changes in investment approaches reflecting the increasing focus on corporate responsibility and ethical investing, as well as the growing importance of ESG factors in investment decisions, enabling the development of ESG asset products. Over the years, the concept of SRI has evolved significantly. Initially, it was rooted in ethical considerations and avoiding investment in companies with questionable health, human rights, or environmental management practices. Today, it has broadened to include investments that support social and environmental objectives like the Sustainable Development Goals (Junkus & Berry, 2015). While most of these moves could be associated to a normative approach, based on the stakeholders and/or the sustainability theories stressing the right to information about how an organisation affects the stakeholders' decisions (Deegan, 2009). Over the last decade a shift towards integrating ESG factors in investment decisions is underway (Roselle, 2016), responding to institutional pressure, mainly from EU bodies. If asset managers process and reporting practices are the result of institutional pressures, as stated by Farooq & Maroun, (2017), we may be in the presence of a coercive isomorphism (Moll et al., 2018), which suggests a focus on complying with rules rather than to provide the best and most useful information to investors.

Asset managers have been increasingly integrating ESG considerations into their

portfolio management, investment analysis and decision-making processes in response to the growing demand from asset owners for ESG management. ESG investment strategies have evolved from exclusionary screenings, which excluded certain sectors, companies or practices based on ESG criteria specific to a fund or portfolio (Melas et al., 2017), to the integration of ESG factors in traditional investment analysis, seeking long-term profitability and risk management (Harper, 2020). Subsequently, the evolution to the Best-in-Class Selection strategy involved investing in companies that led their respective sectors in ESG performance. This strategy identifies and invests in the top players in terms of ESG criteria within any given industry (Giese et al., 2019), thus highlighting the normative focus. Other investment strategies developed such as the Thematic Investing strategy, aiming to direct capital towards opportunities that arise from ESG trends or challenges, or the Active Ownership and Engagement strategy, used by asset owners to interact directly with companies with the aim of influencing companies' ESG best practices and results (Dulari Pancholi, 2022), could also be framed in stakeholders' based theories. Indeed, it is the stakeholders' increasing concern about the environmental and social impact of their investments that has led to the development of the Impact Investing investment strategy, which objective is to generate specific social or environmental benefits in addition to financial gains (Ehlers et al., 2023). Therefore, since the birth of Socially Responsible Investment (SRI), profitability, liquidity and risk have been complemented by ESG factors, which can have a positive or negative impact on an entity's financial results or solvency (European Banking Authority, 2021). These factors are the key points to consider in the investment analysis and decision-making process to achieve long-term value growth (Li et al., 2021).

Due to the growth of ESG investments and the need to combat greenwashing, the EU published the Directive 2014/95/EU aimed at the disclosure of non-financial

information, and the Regulation 2019/2088 with the aim of establishing a regulatory framework to define what characteristics an investment must meet to be considered as sustainable. Sustainable investments are defined as those investments made in an economic activity that contribute to environmental or social objectives measured through key indicators, provided that such investments do not significantly harm any of these objectives, and the beneficiary companies follow good governance practices. Sustainable investment products are thus classified as Article 8 or Article 9 products depending on whether their investment strategy promotes social or environmental characteristics or aims at sustainable investment, respectively.

The importance of redirecting capital flows towards sustainable investment and of integrating environmental, social and governance (ESG) considerations throughout the investment process (Uzsoki, 2020) has led to rapid growth in ESG investment. Drei et al. (2019) analyse the impact of ESG investing, concluding that ESG asset management has experienced double-digit growth rates in 2018. According to The Global Sustainable Investment Alliance (GSIA), in its latest Global Sustainable Investment Review 2020 (2021), global sustainable investment increased by 15% in the last two years, with sustainable investment assets accounting for 35.9% of total assets under management, with Europe and the United States accounting for more than 80% of global sustainable investment assets in the last two years. According to Spainsif (2021), total ESG assets increased by 21%, accounting for 54% of total market assets in 2020 and thus outperforming traditional investments. Morningstar, in its Global Sustainable Flows analysis¹, notes at the European level in December 2022, that assets in European

¹ Bioy, Hortense (2nd February 2023). Flujos sostenibles a nivel mundial. Morningstar. Accessed on the 6th May 2023 from <https://www.morningstar.es/es/news/231468/flujos-sostenibles-a-nivel-mundial.aspx#:~:text=Los%20fondos%20sostenibles%20estadounidenses%20perdieron,0%2C460%20millones%20en%20el%20tercero>

sustainable funds amounted to EUR 2.1 billion, up 12.7% in the last three months and almost at the same level as the figure for the first quarter of 2022. In addition, 159 new sustainable products launched in the fourth quarter were identified. While this rapid growth in ESG investment responds to a consolidated trend, it is hard to assess how the institutional pressure derived from the regulation has possibly impacted the asset managers and owners' behaviour.

2.2 Measuring and disclosing ESG impacts

The origin of the recent sustainability financial regulation was Directive 2014/95/EU of the European Parliament and of the Council, which aimed at the disclosure of non-financial information and diversity information for large companies, with the objective of identifying risks that would improve sustainability and increase investor and societal confidence. Its objective was to improve the disclosure of social and environmental content information by companies to improve the consistency and comparability of non-financial information disclosed in the European Union on ESG issues. The directive sought to improve the transparency and accountability of companies in relation to their ESG practices and to provide stakeholders with relevant and reliable information. The Law did not standardise the way in which information should be published, allowing for a wide dispersion of reports (Ibáñez Jiménez, 2021). As a result, european banks' reporting was not harmonised, with different levels of information depending on the country, regulations and disclosure frameworks adopted (Cosma et al., 2020).

Regulations have continued to reflect the plurality, both in breadth and quality, of non-financial disclosures (Aguado-Correa et al., 2023). On the other hand, with Directive 2014/65/EU of the European Parliament and of the Council, the well-known MiFID II was born with the aim of establishing rules for investment services and activities across the EU. The directive aimed to improve the functioning of financial markets and to

enhance investors' protection. This regulation was complemented by Delegated Regulation (EU) 2021/1253, also known as MiFID Green, so that institutions had to assess investor sustainability preferences alongside traditional risk and return criteria.

The growth of ESG investments and the increased concern of investors for the social and environmental impact of the companies in which they invest their money (Balaguer Franch, 2007), has led shareholders to put pressure on companies to adopt a sustainable behaviour. Eccles et al. (2014) compared 90 companies with a high level of sustainability and 90 companies with a low level of sustainability and concluded that companies with a high level of sustainability performed better than companies with a low level of sustainability in stock market and accounting terms. Kim et al. (2021) analysed 4,708 companies across all sectors, concluding that ESG factors have a positive impact on company profitability and ESG scores have a positive impact on credit quality. Abate et al. (2021) analysed the ESG ratings of a sample of 634 European investment funds and found a positive relationship between ESG performance and financial performance. Sassen et al. (2016), in their analysis of the relationship between CSR and risk for 8,752 European companies between 2002 and 2014, found that higher ESG scores were associated with lower risk. Ultimately, the long-term value created is reflected in improved financial performance which, coupled with the investors' increasing concern about ESG issues, is causing it to become mainstream (Zumente & Bistrova, 2021). The pursuit of long-term value creation for shareholders has led to non-financial disclosure playing a crucial role, resulting in greater regulation on transparency and non-financial reporting that integrates ESG issues (Dmuchowski et al., 2023). However, the lack of clarity and standards in integrating ESG issues into investment processes is yet a challenge (Briand et al., 2011).

For this reason, the European Commission (2018) established that environmental and

social aspects must be considered when making investment decisions and, given the need to disclose such information to shareholders, the EU established in the Regulation 2019/2088 of the European Parliament and of the Council, known by the acronym SFDR, with the objective of establishing harmonised rules on transparency to financial market participants and financial advisors regarding the integration of sustainability risks, the analysis of sustainability-related principal adverse impacts (PAIs) in their processes and sustainability-related disclosures on financial products (The European Parliament, 2019). Furthermore, the Regulation (EU) 2020/852 of the European Parliament, seeks to establish a standardised system for identifying environmentally sustainable economic activities and combating greenwashing. This regulation obliges financial market participants and issuers of financial products to disclose the extent to which their investments are aligned to the taxonomy. Additionally, other relevant norms have been issued, such as the Regulation (EU) 2021/2139 of 4 June 2021, defining technical selection criteria to determine whether an economic activity contributes to climate change mitigation or adaptation, the Regulation (EU) 2021/2178 of 6 July 2021, specifying the content and information required to disclose information on environmentally sustainable economic activities, or the Directive (EU) 2022/2464 of 14 December 2022, on Corporate Sustainability Reporting Directive (CSRD), that outlines the requirements for companies to report on their environmental, social, and governance (ESG) activities, aiming to improve transparency and accountability in sustainability, among other².

The Regulation sets out detailed requirements for market participants to disclose

² Regulation (EU) 2022/1214, which concerns economic activities in certain energy sectors and the information that must be disclosed about them, and Regulation (EU) 2023/2486, which concerns economic activities that contribute to the protection of water and marine resources, the transition to a circular economy, the prevention and control of pollution, and the protection and recovery of biodiversity and ecosystems, and the information that must be disseminated about them.

information on their investments sustainability. It requires companies to report on how they integrate ESG factors into investment decision-making and to provide information on the environmental and social impact of their investments, making it easier for investors to compare different products. This includes providing detailed information on climate-related risks and EU Taxonomy alignment for meeting the SFDR requirements (Gebhardt et al., 2023). In addition, the regulation sets out general rules for classifying and reporting on sustainability and ESG criteria to improve transparency. This encompasses concerns about sustainability risks and principal adverse sustainability impacts at the financial product level, as well as precontractual disclosures (Malecki, 2022). Institutions must include information on sustainability risks and their impact on investment decisions in pre-contractual documents. This ensures that investors are well-informed about sustainability aspects before investing. Financial market participants are also required to regularly report on the environmental or social characteristics of financial products and their consistency with investment strategies. Furthermore, entities' websites should provide information regarding their sustainability risk policies, adverse sustainability impacts, and alignment with sustainability objectives.

Additionally, transparency is necessary regarding how remuneration policies align with the integration of sustainability risks. It also establishes a classification system for sustainable investments, setting out the criteria and methodologies that must be met for an investment to be considered sustainable. To this end, the Regulation classifies investments in Article 6, where an investment does not have sustainable characteristics and is then classified as non-sustainable, in Article 8, when an investment promotes environmental or social characteristics or both, and Article 9, when an investment aims at sustainable investments, i.e., it explicitly aims to have a positive environmental or social impact.

The most challenging aspect of complying with this regulation is determining how to measure the principal adverse material impacts (PAIs), understood as those impacts of investment advice and decisions that have negative effects on sustainability factors. The EU has identified 64 adverse impact indicators to be calculated, of which 18 will be mandatory to report and 46 voluntaries, focusing on ESG factors. The mandatory ones range from carbon emissions, fossil fuel exposure and waste levels (E), to gender diversity and human rights due diligence (S) and the company's track record on exposure to corruption, bribery, or other scandals (G). However, it does not set out methodologies for measuring these indicators.

Given the difficulty of measuring PAIs and developing internal methodologies and procedures, the European Commission decided to launch a consultation³ in 2023 on the SFDR Regulation with the aim of improving the regulatory framework, the customer understanding and requiring companies to review their internal methodologies and procedures. The findings⁴ revealed a high level of consensus regarding the objectives of the SFDR, the uniform disclosure requirements and the categorisation system for sustainable products. However, limitations were also identified about legal ambiguities and data availability, the lack of consistency of the SFDR with the EU Taxonomy, the CSRD and MiFID II. Nevertheless, the European Commission has not yet determined whether it will address the amendment or the timing of the SFDR Regulation should it be decided to adapt it.

³ European Commission (2023). Targeted Consultation Document. Implementation of the Sustainable Finance Disclosures Regulation (SFDR). Accessed on the 20th December 2023 from https://finance.ec.europa.eu/document/download/99bc25fe-4dd8-4b57-ab37-212b5ab05c41_en?filename=2023-sfdr-implementation-targeted-consultation-document_en.pdf

⁴ European Commission (2024). Summary report: public and targeted consultations on the implementation of the Sustainable Finance Disclosures Regulation (SFDR). Accessed on the 10th May 2024 from https://finance.ec.europa.eu/document/download/0f2cfde1-12b0-4860-b548-0393ac5b592b_en?filename=2023-sfdr-implementation-summary-of-responses_en.pdf

Precisely for being challenging, and for combining mandatory and voluntary indicators, assessing how PAIs are being measured and reported by asset managers could help understand their approach and degree of engagement with sustainability, as well as their main lever, whether responding to the market/stakeholders' expectations, or complying to institutional regulation.

This is why companies specialising in company and investment analysis, such as Morningstar (Bioy et al., 2024), report on how fund classification, flow variation, alignment with EUR Taxonomy and PAIs have evolved. However, regarding the PAIs, they only refer to the 18 mandatory indicators without analysing within each of these which of the sub-indicators is the most used. Furthermore, when analysing whether funds report on PAIs and/or alignment with EU Taxonomy, only Articles 8 and 9 are considered. Indeed, Article 6 funds are being overlooked, even though Article 6 funds may report on PAIs or on their alignment with the EU Taxonomy, even if they aren't necessarily designed with environmental sustainability in mind and are not required to meet the demanding criteria set out in Articles 8 and 9.

To our knowledge, there are no studies that have quantitatively analysed which principal adverse events are being considered in advice and investment decisions among the set of mandatory and voluntary indicators identified by the EU, characterised by their difficulty to measure and the lack of a standardised methodology. Therefore, the first research question of this study is:

- (RQ1): What are the indicators most used by the market to report PAIs?

On the other hand, the EU, through different regulations, aims to redirect economic flows towards sustainable investments. However, we do not know to what extent are Article 6, Article 8 and Article 9 funds reporting alignment to the taxonomy and the

percentage of reported alignment, which could be considered as a signal of voluntary engagement with sustainability reporting to stakeholders. Therefore, our second research question in this study is:

- (RQ2): Are funds reporting alignment to the taxonomy?

Our study addresses this gap by quantitatively analysing what effect the SFDR regulations have had on funds in the market, analysing the variables they report in the European ESG Template (EET).

3. Methods

The study of how Regulation 2019/2088 has led to increased transparency in the financial market and how financial market participants analyse the principal adverse impacts (PIAs) on sustainability factors in their decision-making and advisory processes requires an analysis of the information they disclose. To this end, the European ESG Template (EET), used by funds to disclose their ESG information, has been taken as the main source of data.

The European ESG Templates (EETs) are standardized frameworks developed to facilitate consistent reporting and disclosure of environmental, social, and governance (ESG) criteria by financial and investment products in Europe. The aim of these templates is to increase transparency and enable investors to make well-informed decisions based on sustainability factors. The EET assists in aligning financial product information with EU sustainability regulations, including the Sustainable Financial Disclosure Regulation (SFDR) and the EU Taxonomy Regulation. However, publication isn't mandatory.

FinDatEx (Financial Data Exchange Templates), a consortium that plays a crucial role

in TSE development, created and published these templates in March 2022. The European financial services industry has established a collaborative initiative to facilitate the exchange of data among its participants. The primary aim of this initiative is to reduce the compliance burden associated with EU financial market directives and regulations by creating standardized templates.

As for the sample, the top 20 fund managers with the highest total assets (US\$) in 2022, according to the Thinking Ahead Institute⁵ (Table 1), were selected for this study. The objective of this study was to ascertain whether all fund managers had reported ESG information and whether they had reported the European ESG Template. To this end, the templates were accessed in April 2024, and the information used for the analysis pertains to the period from December 2023 to March 2024. This methodology ensures that the information is the most up-to-date. Furthermore, as the companies have already reported on the taxonomy in 2023, the data is carried forward in the EETs. Following the analysis, those managers who did not report TSEs were excluded from the final sample, which represented 48.5% of the assets in the sample.

Within this framework, we have identified those variables of the EETs that report whether the financial instrument is classified as Article 6, Article 8, or Article 9, whether they use PAI indicators, and what type of indicators they use on climate, environmental and social issues. Once these data were extracted, a quantitative analysis was carried out to determine the composition of the sample according to their classification, the use of PAI indicators and the type of PAI indicators. The sample finally consisted of 6,382 financial instruments.

⁵ Thinking Ahead Institute (October 2023). The world's 20 largest Asset Managers as 2022. Accessed on the 8th January 2023 from https://www.thinkingaheadinstitute.org/content/uploads/2022/10/PI-500-2022_final_1013.pdf

Ranking	Asset Manager	Market	Total assets (US\$)	%	F _i
1	BlackRock	United States	10.010.143	16,8%	16,8%
2	Vanguard Group	United States	8.466.372	14,2%	31,1%
3	Fidelity Investments	United States	4.233.825	7,1%	38,2%
4	State Street Global	United States	4.138.172	7,0%	45,1%
5	J.P. Morgan Chase	United States	3.113.000	5,2%	50,4%
6	Allianz Group	Germany	2.954.432	5,0%	55,3%
7	Capital Group	United States	2.715.178	4,6%	59,9%
8	Goldman Sachs Group	United States	2.470.000	4,2%	64,0%
9	BNY Mellon	United States	2.434.330	4,1%	68,1%
10	Amundi	France	2.332.454	3,9%	72,1%
11	UBS	Switzerland	2.124.000	3,6%	75,6%
12	Legal & General Group	United Kingdom	1.917.486	3,2%	78,8%
13	Prudential Financial	United States	1.742.326	2,9%	81,8%
14	T. Rowe Price Group	United States	1.687.800	2,8%	84,6%
15	Invesco	United States	1.610.915	2,7%	87,3%
16	Northern Trust	United States	1.607.100	2,7%	90,0%
17	Franklin Templeton	United States	1.578.124	2,7%	92,7%
18	Morgan Stanley Inv. Mgmt.	United States	1.492.849	2,5%	95,2%
19	BNP Paribas	France	1.439.280	2,4%	97,6%
20	Wellington Mgmt.	United States	1.425.481	2,4%	100,0%

Table 1. The world's 20 largest Asset Managers as 2022. Source: Thinking Ahead Institute

3.1 European ESG Template (EET) data analysis

Firstly, to determine whether the regulation has had an impact on the classification of financial products, a quantitative methodology has been used. To this end, the data disclosed by asset managers in the European ESG Templates (EETs) were extracted, using the most up-to-date data from the asset managers. For this purpose, we have identified the variable “10040_General_Reference_Date” to ensure that the reference date of the information is the most up to date. Secondly, to understand the impact of the regulation on the classification of products, we have analysed the composition of Total Assets according to their classification as Article 8, Article 9 or Article 6 (Table 2). For this purpose, we have identified the variable “20040_Financial_Instrument_SFDR_Product_Type”.

Variable	Identification	Definition
6	Article 6	"A financial product which is not an Article 8 or Article 9 financial product".
8	Article 8	"A financial product promotes, among other characteristics, environmental or social characteristics, or a combination of those characteristics, provided that the companies in which the investments are made follow good governance practices".
9	Article 9	"A financial product has sustainable investment as its objective".

Table 2. "20040_Financial_Instrument_SFDR_Product_Type" variable definitions

In addition, to identify the degree of alignment of investments to the European taxonomy, we have identified the following variables (Table 3):

Code	Definition
20180	For art 8 products, the minimum proportion of sustainable investments.
20190	Does the minimum specified in field 20180 include EU Taxonomy sustainable investment?
20220	For art 9 products, the minimum proportion of sustainable investments with environmental objective.
20230	Does the minimum specified in field 20220 include EU Taxonomy Environmental sustainable investment?
20450	Percentage of sustainable investments aligned with the EU Taxonomy
20540	Percentage of sustainable investments aligned with EU Taxonomy in latest report

Table 3. EU Taxonomy variables

The results obtained were:

- For the variable 20190, "N" is obtained if it was not a sustainable financial instrument Article 8 according to the EU Taxonomy, and "Y" if it was. If not reported, it was taken as "N".
- For the variable 20230, "N" is obtained if it was not an environmentally sustainable financial instrument Article 9 according to EU Taxonomy, and "Y" if it was. In the case of not being informed, it was taken as "N".
- For the variable 20450, a number reporting in percentage could be obtained. If not reported, it was taken as a "0".
- For the variable 20540, a number reporting in percentage could be obtained. If not reported, it was taken as "0".

Finally, in order to know to what extent, the principal adverse incidents (PAIs) are being considered in their financial instruments, we have identified the variable “20100_Financial_Instrument_Does_This_Product_Consider_Principle_Adverse_Impact_In_Their_Investment” which reports with "Y" if it takes them into account and with "N" if it does not take them into account (Table 4). Those PAIs that are not reported have been defined as "N". To know which PAIs are being taken into account, we have extracted the variables identified in Table 3 that correspond to the indicators that have to be published due to the regulations.

Investment	Area	Adverse sustainability indicator		Code*
Investee companies	Climate and other environment	Greenhouse gas emissions	Greenhouse gas emissions	
			Scope 1 GHG emissions	30030
			Scope 2 GHG emissions	30070
			Scope 3 GHG emissions	30110
			Total GHG emissions	30190
			Carbon footprint	
			Carbon footprint Scope 1,2	30230
			Carbon footprint Scope 1,2,3	30270
			GHG intensity of investee companies	
			GHG intensity of investee companies Scope 1,2	30310
			GHG intensity of investee companies Scope 1,2,3	30350
			Exposure to companies active in the fossil fuel sector	30390
			Share of non-renewable energy consumption and production	
			Share of non-renewable energy consumption	30430
			Share of non-renewable energy production	30470
			Energy consumption intensity per high impact climate sector	
			Sector NACE A	30510
			Sector NACE B	30550
			Sector NACE C	30590
			Sector NACE D	30630
			Sector NACE E	30670
			Sector NACE F	30710
			Sector NACE G	30750
			Sector NACE H	30790
			Sector NACE L	30830
	Social and employee, respect for human rights, anti-corruption and anti-bribery matters	Biodiversity	Activities negatively affecting biodiversity- sensitive areas	30870
		Water	Emissions to water	30910
		Waste	Hazardous waste and radioactive waste ratio	30950
		Social and employee matters	Violations of UN Global Compact principles and Organisation for Economic Cooperation and Development (OECD) Guidelines for Multinational Enterprises	30990
			Lack of processes and compliance mechanisms to monitor compliance with UN Global Compact principles and OECD Guidelines for Multinational Enterprises	31030
			Unadjusted gender pay gap	31060
			Board gender diversity	31100
			Exposure to controversial weapons (anti-personnel mines, cluster munitions, chemical weapons and biological weapons)	31140
		Environmental	GHG intensity	31180
		Social	Investee countries subject to social violations	31220
Real estate assets		Fossil fuels	Exposure to fossil fuels through real estate assets	31300
		Energy efficiency	Exposure to energy-inefficient real estate assets	31340

Table 4. Indicators identifying the PAIs

3.2 Reporting impact

Firstly, we have drawn on the study by Krombholz et al. (2022) in which they investigate whether so-called impact funds, i.e., funds that have a real-world impact, meet the requirements of real impact investments. For this purpose, we have analysed whether the financial instruments reported by the fund managers have a mostly sustainable composition or, on the contrary, are financial instruments that do not include sustainable characteristics. For this purpose, the proportion of article 6, article 8 and article 9 products in the total sample analysed was calculated. This implies that a higher number of Article 8 and Article 9 financial instruments means a higher degree of sustainability in the investments made by the asset managers. Secondly, we have drawn on the study by Badenhoop et al. (2023) on how the SFDR regulation has affected the classification of funds in banks in Germany to analyse whether alignment to the taxonomy is being considered and where an alignment with the EU Taxonomy of 5% was identified, which was determined as a low degree of alignment. In order to achieve this objective, the variables 20190, 20230, 20450 and 20540, which report on the taxonomy in the EETs, have been subjected to analysis. The objective of this analysis is to ascertain whether in the financial instruments the taxonomy alignment is being taken into account. Consequently, the analysis proceeded to determine whether the reporting of taxonomy alignment was present (Y) or absent (N). Furthermore, the proportion of investments aligned with the disclosed taxonomy was evaluated, with the objective of identifying whether it was low, i.e., less than 5% for Article 6, 8 and 9 funds, in accordance with the findings of the study.

Finally, to find out whether they are considering PAIs, we analyse whether they are

considering them and, if they are, what indicators they are using to measure them. For this purpose, we have identified for each of the categories of funds, the frequency of use of each of the indicators as a whole and we have calculated the % of use of these indicators in relation to the total for each of the categories.

4. Results

Firstly, the analysis of the composition of the asset managers' portfolios of financial instruments showed that 56% of the financial instruments were classified as sustainable, the majority being Article 8. From this result we can extract that 53% of the financial instruments promote environmental and social characteristics, but only 3% pursue a sustainable investment objective.

Conversely, it's possible to observe the differences between the various fund managers. Vanguard stands out for the high number of instruments classified as Article 6, while Fidelity is notable for its high number of instruments classified as Article 8. Finally, when we analyse the Article 9 instruments, we see a low number of financial instruments, which suggests that it is challenging to assess the alignment with the environmental objectives of the EU Taxonomy.

Asset Manager	Total Financial Instruments	SFDR Product Type				EU Taxonomy Investment		
		Article 6	%	Article 8	%	Article 9	%	
Blackrock	4.615	2.261	49%	2.126	46%	228	5%	0
Vanguard	335	274	82%	61	18%	0	0%	0
Fidelity	1.973	398	20%	1.495	76%	80	4%	42
BNY Mellon	757	379	50%	336	44%	42	6%	0
UBS	2.422	1.028	42%	1.362	56%	32	1%	0
Franklin Templeton	2.791	1.260	45%	1.475	53%	56	2%	0
Total	12893	5600	43%	6855	53%	438	3%	42

Table 5. Investments' reporting aligned to EU Taxonomy by product typology

Secondly, the degree to which financial instruments were aligned to the EU Taxonomy was analysed. The data show that almost all financial instruments are not aligned with

the EU Taxonomy except for some Article 6, representing 0.03%, some Article 8, representing 0.05%, and some Article 9, which represent 0.11% of the sample (Table 5). The analysis revealed that Vanguard reported in Article 6 funds alignment with the EU Taxonomy in the last report, representing 1.7% of the sample.

Furthermore, it can be observed that a low number of the sustainable products in question report alignment levels of more than 0% (Figure 1). This represents 2.3% of the total. In contrast, the products that are reporting alignment show levels of alignment higher than 5%. Most of them report alignment levels above 10% and two Article 8 report alignment above 20%.

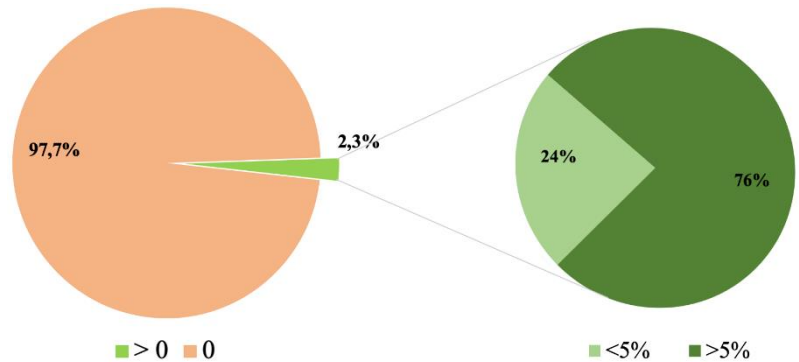


Figure 1. Percentage of sustainable investments aligned with the EU Taxonomy

However, the EU Taxonomy is mandatory for Member States. This contrasts with the number of financial instruments trading in currencies belonging to EU countries. In order to determine whether the low percentage of reported alignment is due to a high number of instruments trading in currencies other than those of EU Member States, the variable 20030_Financial_Instrument_Currency, which reports the currency in which the instrument trades, has been analysed. Table 6 demonstrates that the proportion of financial instruments traded in euro area currency is considerably higher than the low

number of instruments reporting alignment with the Taxonomy, as illustrated in Table 5. The majority of asset managers have more than 30% of their financial instruments traded in an EU currency, with Fidelity having the highest proportion at almost 50%.

Asset Manager	Total Financial Instruments	Financial Instrument Currency	
		EU	Other
Blackrock	4.615	1.795	39%
Vanguard	335	112	33%
Fidelity	1.973	948	48%
BNY Mellon	757	286	38%
UBS	2.422	713	29%
Franklin Templeton	2.791	961	34%
Total	12.893	4.815	37%

Table 6. Percentage of instruments trading in an EU currency

Thirdly, analysing whether they take into consideration the principal adverse impacts (PAIs) on sustainability factors in their decision-making and advisory processes (Table 7), we could observe that most of the PAIs were taken into consideration in Article 8 financial instruments, representing 94% of the total of those financial instruments in which PAIs were taken into consideration.

Asset Manager	Total Financial Instruments	PAIs								
		Article 6	Article 8	Article 9	Article 6		Article 8		Article 9	
					N	Y	N	Y	N	Y
Blackrock	4615	2261	2126	228	2261	0	0	2126	0	228
Vanguard	335	274	61	0	274	0	0	61	0	0
Fidelity	1973	398	1495	80	398	0	0	1.495	0	80
BNY Mellon	757	379	336	42	379	0	103	233	0	42
UBS	2422	1028	1362	32	1.028	0	14	1.348	0	32
Franklin Templeton	2791	1260	1475	56	1.260	0	9	1.466	0	56
Total	12893	5600	6855	438	5600	0	126	6729	0	438

Table 7. Instruments that consider PAIs

Finally, for those financial instruments in which the PAIs were considered, we analysed

how they were considered in Table 8. It was observed that the financial instruments classified as Article 6, although not classified as sustainable, did not take the PAIs into account through indicators except for one case referring to exposure to controversial weapons. On the other hand, in Article 8 products that promote environmental or social characteristics, it was observed that those indicators that were most used to consider the PAIs were the social ones, specifically those related to Violations of UN Global Compact principles and Organisation for Economic Cooperation and Development (OECD), Guidelines for Multinational Enterprises (31030) and Exposure to controversial weapons (31140).

After that, the ones that were most considered were the Exposure to companies active in the fossil fuel sector (30390), Climate and environmental ones, and specifically those related to GHG emissions (30030, 30070, 30310), and GHG intensity (31180), Investee countries subject to social violations (31220) and Board gender diversity (31100). In the case of Article 9 products, it was observed that the most frequently utilized indicators to assess PAIs were also those pertaining to social matters, specifically those related to exposure to controversial weapons (31140) and violations of UN Global Compact and Organisation for Economic Cooperation and Development (OECD) principles, Guidelines for Multinational Enterprises (31030). After these, the most used were those related Climate and environmental ones, and specifically those related to GHG emissions (30030, 30070, 3020, 30310). In proportion to the total number of financial instruments classified as Article 6, Article 8 and Article 9, the financial instruments with the highest number of PAIs used per financial instrument were those classified as Article 9, with twice as many used per financial instrument in Article 8 (Table 9).

Investment	Area	Adverse sustainability indicator	Code*	PAIs			
				Article 6	%	Article 8	%
Investee companies	Climate and other environment	Greenhouse gas emissions	Greenhouse gas emissions				
			Scope 1 GHG emissions	30030	0	0%	3.540
			Scope 2 GHG emissions	30070	0	0%	3.541
			Scope 3 GHG emissions	30110	0	0%	1.907
			Total GHG emissions	30190	0	0%	1.907
			Carbon footprint				
			Carbon footprint Scope 1,2	30230	0	0%	2.390
			Carbon footprint Scope 1,2,3	30270	0	0%	1.862
			GHG intensity of investee companies				
			GHG intensity of investee companies Scope 1,2	30310	0	0%	4.225
			GHG intensity of investee companies Scope 1,2,3	30350	0	0%	2.004
			Exposure to companies active in the fossil fuel sector	30390	0	0%	5.226
			Share of non-renewable energy consumption and production				
			Share of non-renewable energy consumption	30430	0	0%	1.813
			Share of non-renewable energy production	30470	0	0%	2.021
			Energy consumption intensity per high impact climate sector				
			Sector NACE A	30510	0	0%	655
			Sector NACE B	30550	0	0%	718
			Sector NACE C	30590	0	0%	718
			Sector NACE D	30630	0	0%	718
			Sector NACE E	30670	0	0%	718
			Sector NACE F	30710	0	0%	655
			Sector NACE G	30750	0	0%	718
			Sector NACE H	30790	0	0%	718
			Sector NACE L	30830	0	0%	718
			Biodiversity				
			Activities negatively affecting biodiversity- sensitive areas	30870	0	0%	1.423
			Water				
			Emissions to water	30910	0	0%	2.200
			Waste				
			Hazardous waste and radioactive waste ratio	30950	0	0%	2.204
			Violations of UN Global Compact principles and Organisation for Economic Cooperation and Development (OECD) Guidelines for Multinational Enterprises	30990	0	0%	5.870
Social and employee matters	Social and employee matters	Social and employee matters	Lack of processes and compliance mechanisms to monitor compliance with UN Global Compact principles and OECD Guidelines for Multinational Enterprises	31030	0	0%	2.244
			Unadjusted gender pay gap	31060	0	0%	329
			Board gender diversity	31100	0	0%	2.769
			Exposure to controversial weapons (anti-personnel mines, cluster munitions, chemical weapons and biological weapons)	31140	6	0%	6.118
			GHG intensity	31180	0	0%	2.859
Sovereigns and supranationals	Social	Social	Investee countries subject to social violations	31220	0	0%	2.632
			Exposure to fossil fuels through real estate assets	31300	0	0%	117
Real estate assets	Energy efficiency	Energy efficiency	Exposure to energy-efficient real estate assets	31340	0	0%	3

Table 8. Proportion of use of PAI indicators by type of financial instrument

	Article 6	Article 8	Article 9
Total PAIs	6	65.540	9.797
Total financial instruments	5.600	6.855	438
Average per financial instrument	0	10	22

Table 9. Average of PAIs per financial instrument

4.1 Discussion

Firstly, we can observe a lack of homogeneity in the way the financial sector to applies sustainability regulation. The results show how most financial products are classified as Article 8 versus Article 9. While the criteria for classifying financial products as Article 9 are stricter because they must explain what their sustainable investment objective is, how they will achieve it and the sustainability-related metrics used to measure it, in order to classify financial products as Article 8 they must explain how they consider environmental and social characteristics in their management. This may be evidenced

by the fact that Article 6 funds have reported alignment with the EU Taxonomy and have not been classified as Article 8 or Article 9. All this is accompanied by a regulation whose measurements are not standardised and therefore can lead to cases of greenwashing which, together with the inability of national and international supervisors to audit all financial products, means that financial products can be offered as sustainable when they are not. Secondly, the taxonomy's objective of channeling capital flows towards sustainable finance isn't being reflected in investment products at the expected pace, although the levels analysed above are being increased Badenhoop et al. (2023).

The complexity of the variables analysed and of the methodologies that the sector must apply to report the percentage of alignment with the taxonomy of their investments means that the degree of alignment with the taxonomy that they are reporting is practically zero in most financial products. Finally, we have been able to observe that the EU is working on the development of indicators that allow the financial sector to have tools to report on the negative impacts that investment and advisory decisions can have on sustainability factors through the main adverse impacts. However, the lack of standardised methodologies for measuring these indicators means that the sector is limited to using a small number of heterogeneous indicators, which makes comparability difficult. The lack of development of sustainability methodologies that allow the classification of financial products and the calculation of indicators in a homogeneous manner gives rise to the need for resources and capacities on the part of the financial sector and regulators in their supervisory work, which could lead to greenwashing. Therefore, it is necessary that in the next revisions of the regulations, progress is made in the development of standardised methodologies so that the sector has the appropriate tools.

5. Conclusions

European sustainability regulation aims to mobilise capital flows towards sustainable investments as well as to be a driver of transparency in the disclosure of information on sustainable finance. The financial sector, together with other financial market participants, has a necessary role to play in sustainability finance and in the design of sustainable financial products. Therefore, sustainability regulation must provide standardised methodologies to all market participants. However, this remains a constraint for the sector that needs to be addressed in the coming years. Analysing the impact of sustainability regulation on the financial sector is important to understand how sustainable products and the standardisation of reporting are progressing (Ibáñez Jiménez, 2021).

Analysing the ESG variables and indicators reported by asset managers' funds can increase understanding of how legislation is causing capital flows to be redirected to sustainable investments, the extent to which these products are sustainable and aligned to European taxonomy, and how ESG issues are taken into account that may impact, bringing clarity and transparency to the challenge of how to integrate ESG issues into the investment process (Briand et al., 2011).

Our results depict the role of the financial sector in moving towards sustainability and understanding how regulation impacts on sustainable disclosure of financial products and services. The results help industry participants to understand how their peers are using the disclosure tools provided by the EU on sustainability and the need to advance the development of standardised methodologies and indicators to enable comparability.

A clear example of this is that Regulation 2019/2088 does not establish a standardised

methodology for each of the indicators that financial market participants must report on, which is a limitation when comparing the degree of alignment with sustainability and how they consider the PAIs of their investments. The need for standardised rules that, in addition to making disclosure mandatory, develop common methodologies for measurement is necessary in the financial sector to improve transparency and customer protection.

From a theoretical perspective, the fact that funds are not actually developing sound methodologies and indicators to maximise the usefulness of the information reported, but just complying with the mandatory requests from the legislation, shows little proactivity and focus on the stakeholders' interests. Assuming Deegan (2011) notion of accountability from the normative perspective, in which stakeholders have a right to information about how an organisation affects them, or their decisions, the funds approach seems not close to the stakeholders' theory. On the contrary, the funds behaviour appears to be driven by the obligation to comply with regulations, in line with the idea that organisational structures, processes and practices are the result of institutional pressures (Farooq & Maroun, 2017), thus suggesting an institutional or neo-institutional approach. Furthermore, the homogeneity observed in the different funds behaviour, indicates a coercive isomorphism, since organisations are forced by external factors to apply specific internal structures and procedures (Moll et al., 2018).

This article contributes to the literature by providing results on a recent regulation in the European regulatory framework, which in future revisions will require participants to make greater efforts to improve transparency in the disclosure of information on sustainability. Specifically, it provides information on those indicators of PAIs that are most used by the sector and the degree of progress in redirecting capital flows towards investments in line with the EU Taxonomy. Although the information is based on

specific fund managers and a large sample, the fact that not all fund managers disclose information through EETs can be considered as a limitation of the study. The analysis carried out on the EETs variables made it possible to recommend reporting the percentage of companies that are obliged to disclose information due to Directive 2014/95/EU or CSRD and therefore report in line with the taxonomy and, on the other hand, to recommend that Article 6 funds be included in the analyses, as they may report alignment with the taxonomy. If the study were conducted with a larger sample, the scope and extrapolation of data to the whole industry could be improved. From the point of view of continuing in this line of research, one line for continuity would be the analysis of the differences in methodologies used for the calculation of the PAI indicators.

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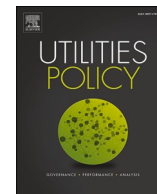
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5. Capítulo quinto. Definición y medición de recursos financieros para la economía circular en inversiones sostenibles

5.1 Definición y medición de recursos financieros para la economía circular en inversiones sostenibles

El quinto capítulo versa sobre el cuarto estudio de la Tesis, que se encuentra actualmente *IN PRESS* en la revista Utilities Policy: Portillo-Tarragona, P., Llera-Sastresa, E., Scarpellini, S. & Benito Bentué, D. (2025). *A case study of financing zero-emission power-to-gas technologies in Spain*. <https://doi.org/10.1016/j.jup.2025.101965>



Full-length article

A case study of financing zero-emission power-to-gas technologies in Spain

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ABSTRACT

A zero-emissions scenario entails new energy systems minimizing short and medium-term carbon emissions and transitioning to renewable sources in the long term. In the face of these challenges, information about investments in sustainable energy technologies has to be considered a priority issue for many industry organizations, as it is still an incipient topic in academic literature. In this scenario, this study considers and prioritizes the financial resources mobilized for investments in power-to-gas technologies because they contribute to producing clean and efficient fuels from renewables or carbon-neutral sources. This process typically involves electrolysis to produce hydrogen converted to synthetic gas, which is used as a storable form of renewable energy. This study is essentially qualitative and exploratory, based on semi-structured interviews with experts to help define and classify the financial resources that investments require for these technologies in Spain. We study the institutional influence on the power-to-gas deployment and reflect on how the mobilization of specific resources can contribute to these zero-emission technologies and the related social metrics for reporting sustainable investments, also from the perspective of a Spanish financial institution as an exploratory case study. This study provides theoretical and practical insights regarding the current and future mobilization of financial resources for investments in power-to-gas technologies and energy utilities' sustainable finance policies in a zero-emissions scenario.

1. Introduction

The current transition towards a low-carbon energy scenario involves changes in technologies influenced by institutional policies and principles such as affordability, security of supply, and sustainability (Milchram et al., 2019; Scharf and Möst, 2024). In this context, significant investments in sustainable energy technologies are expected (Llera-Sastresa et al., 2020), requiring a structured framework for mobilizing financial resources in innovative technologies (Scarpellini et al., 2021).

This progressive interest in the financial field to redirect capital flows towards sustainable investments led the European Union (EU) to establish a unified classification for sustainable investments under the "European Union Taxonomy for Sustainable Investments", detailed in Regulation (EU) 2020/852 (European Parliament, 2020). This regulation, known as "taxonomy", meant a significant change, both for the

financial system and for companies that have to apply the classification of investments and the homogenization of different environmental impact categories, as established by the European Parliament (2020).

The EU Taxonomy is not mandatory, but it provides transparency on the classification and the disclosure of the proportion of private investments eligible under the Taxonomy (Schütze and Stede, 2024). In this framework, investors can make an informed choice, and its application contributes to clearing up the dilemma behind making nuclear and gas sustainable (Tettamanzi et al., 2023).

These investments in sustainable technologies include those aimed at achieving an energy scenario of zero emissions that goes beyond the exploitation of renewables for electricity generation and is promoted in the EU for the substitution of fossil fuels. Power-to-gas (PtG) represents an innovative technological approach aimed at the chemical storage of electrical energy in the form of gases, primarily hydrogen or methane. This technology chain is centered on electrolysis, which uses electrical

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energy to split water into hydrogen and oxygen. Electrolysis serves as the cornerstone of PtG, facilitating subsequent processes such as methanation and hydrogenation, which enable the conversion of hydrogen into more complex hydrocarbons (Romeo and Bailera, 2020).

Despite being more expensive than traditional fossil fuel-based methods currently, PtG's economic prospects are steadily improving. When integrated with high carbon pricing mechanisms, PtG becomes an economically viable solution that significantly reduces emissions (Yilmaz et al., 2022). Advances in catalysts, reactor design, and system efficiency drive down costs, while increased adoption and scaling of PtG technology enhance production efficiencies. Achieving widespread feasibility, however, will depend on continued progress in reducing capital expenditures, electricity costs, and the price of feedstock materials, particularly for processes involving hydrogen conversion (Gorre et al., 2020).

These technologies are mobilizing vast volumes of financial resources for their deployment, which will increase in the coming years (Llera-Sastresa et al., 2020), and they are included in the EU Taxonomy for sustainable investments because they contribute to the production of clean and efficient fuels from renewables or carbon-neutral sources (section 10.h),

This topic is not unprecedented since the need to define and measure financial resources applied to investments in renewable self-consumption (Scarpellini et al., 2021), to new technologies for eco-innovation (Scarpellini et al., 2018), or for the circular economy (Aranda-Usón et al., 2019). However, sustainable financing, public financing, and private investment are little-explored aspects of research addressing renewable hydrogen (Goodwin et al., 2024). In addition, the analysis of mobilizing financial resources for PtG technologies is still in the early phase. Consequently, the general purpose of the study is to increase knowledge about the definition, measurement, and management of financial resources mobilized for sustainable investments in PtG and the relative social impacts of reporting.

Our study explores three primary research questions.

RQ1. How could the institutional environment influence the PtG technologies' investments through different mechanisms in transitioning to a zero-emissions energy scenario in a territory?

RQ2. What financial resources can be mobilized for sustainable energy technologies in a given territory, including investments in PtG?

RQ3. How can the socio-economic and social impacts of investments in PtG as a sustainable energy technology be measured?

This study aims to achieve these objectives by performing a qualitative analysis of financial resources for PtG investments, using a methodology that includes semi-structured interviews with experts. We use the interviews to develop a case study of a specific financial Spanish institution to consider specific metrics for reporting. We consider how their measurement facilitates reporting in a renewable and zero-emissions energy scenario within the framework of the Directive, defined as CSRD (European Parliament and the Council, 2022), given the proliferation of investments in sustainable energy technologies.

The rationale of this article is as follows: after this introduction, the background underlying the research is summarized. The methodology and case study are detailed in the third section. The main results are described in the fourth section, which ends this paper with conclusions from the research.

2. Background and literature review

In the coming years, a considerable amount of investment is expected in more sustainable technologies to achieve a zero-emission energy scenario (Bovera and Lo Schiavo, 2022). It is, in particular, necessary to increase the limit on renewable sources without implying their oversizing in the network (Dellano-Paz et al., 2015) and to expedite the substitution of fossil fuels through the production of synthetic gas from

renewable sources using PtG technologies (Bailera et al., 2017).

In considering this challenge, PtG is postulated as a power storage system that promotes new renewable capacity without congestion and instability in the electricity grid, making it possible to avoid costly electricity grid extension. PtG can also be a carbon capture technology when synthetic methane is produced. The process potentially becomes zero or net-negative emissions if the required CO₂ is captured. However, reducing environmental impacts and climate improvements depend on the captured CO₂ and electricity sources. As Blanco et al. (2020) state, using biogenic CO₂ sources and renewable electricity for electrolysis leads to the most significant decrease in greenhouse gas emissions. Still, some fund managers could prefer investing in energy markets with higher returns over extended periods.

One of the primary barriers to adopting power-to-gas (PtG) technologies is the high capital cost of its components, with electrolyzers representing approximately 74 % of the total investment in large-scale PtG plants. Additional significant costs include hydrogen storage and methanation systems, which, while scalable, remain prohibitively expensive for smaller facilities. For example, methanation system costs range from €400/kW for smaller plants to €130/kW for larger installations, underscoring the economic advantages of scaling up and creating synergistic systems to reduce costs (Borge-Diez et al., 2023).

Without substantial cost reductions, PtG technologies face challenges in achieving the scale necessary for meaningful market penetration, particularly in regions with well-established alternatives (Andrade et al., 2022; Preston et al., 2020). However, PtG offers a promising solution for energy-intensive industries such as cement, glass, and sanitary ware production, which depend heavily on natural gas (NG) for high-temperature processes. Synthetic methane (SM) produced via PtG can directly substitute for NG, reducing external energy dependency and greenhouse gas emissions. This aspect is particularly relevant in the European Union, where some member states' natural gas dependency reaches 90–100 %. On-site SM production in industrial facilities enhances energy security and mitigates risks associated with volatile NG prices. Furthermore, integrating carbon capture systems with PtG technologies enables the utilization of CO₂ emissions from industrial processes, such as cement production, to produce SM. This approach reduces emissions and provides a scalable alternative to NG in industrial applications.

The socio-economic implications of PtG technologies are also significant. By reducing external energy dependency and stabilizing energy costs, PtG can enhance the competitiveness of European industries and mitigate the risk of deindustrialization. The energy transition is essential for energy-intensive industries facing rising NG prices and increasing pressure to decarbonize. Moreover, deploying PtG systems can contribute to job creation and social equity by supporting the transition to a low-carbon economy.

Despite these advantages, the current cost of synthetic methane is at least three times higher than conventional NG, creating a significant economic barrier. While rising NG prices could narrow this gap, the slow pace of cost reductions in hydrogen production systems, compounded by inflation and supply chain disruptions, remains a critical concern (Borge-Diez et al., 2023). A robust carbon pricing mechanism could significantly enhance the economic and environmental competitiveness of PtG systems by incentivizing the use of low-carbon electricity and CO₂ recycling. Such mechanisms would improve the financial viability of PtG and align its deployment with broader decarbonization goals.

Reversible PtG systems, designed to produce hydrogen or synthetic methane during periods of low electricity prices (e.g., surplus renewable energy) and generate electricity from stored gas during high-price periods (e.g., demand peaks), offer a promising pathway to improve the economic performance of PtG technologies. These systems provide flexibility by converting electricity to gas and back to electricity, enabling them to adapt to market conditions (Fambri et al., 2022). They also play a critical role in balancing supply and demand in grids with high shares of intermittent renewable energy, such as wind and solar,

thereby supporting the transition to low-carbon electricity grids. For instance, research in the Baltic states and Germany has demonstrated that PtG can reduce wind curtailment and enhance the flexibility of integrated gas-electricity systems. These benefits are particularly pronounced when PtG is combined with complementary technologies, such as batteries, to create multi-energy systems (Andrade et al., 2022).

However, the economic viability of reversible PtG systems is highly dependent on electricity market conditions, particularly price volatility. In regions with high renewable energy penetration and significant price fluctuations, reversible PtG systems are economically viable due to their ability to capitalize on low and high electricity prices. This flexibility improves capacity utilization and revenue generation, making reversible PtG systems more competitive than one-directional electrolyzers, especially at current hydrogen prices. Conversely, in regions with high renewable energy penetration but lower price volatility, the economic case for reversible PtG systems is less compelling. The above highlights the importance of market-specific conditions in determining the feasibility of PtG technologies (Fambri et al., 2022).

Another critical barrier to PtG adoption is the limited availability of hydrogen infrastructure, including pipelines, storage facilities, and distribution networks. This infrastructure gap restricts the scalability of PtG technologies and limits their market potential. Without significant investments in hydrogen infrastructure, the broader utilization of green hydrogen and synthetic methane will remain constrained, reducing investor confidence and slowing deployment (Borge-Diez et al., 2023). This limitation also restricts PtG's ability to meet the growing demand for green gases across industrial, transportation, and residential sectors. Additionally, competition from more established energy storage technologies, such as batteries, further limits PtG's market potential. Without clear policy support to level the playing field, PtG technologies may struggle to demonstrate their value proposition and secure a competitive position in the energy landscape.

Risk allocation represents another significant challenge, particularly due to the technological immaturity and integration complexities of PtG systems. Investors often hesitate to fund projects reliant on emerging technologies with uncertain performance and high upfront costs. Integrating PtG systems into existing energy infrastructure, such as electricity grids and natural gas networks, adds further complexity and risk. These factors complicate the effective allocation of risks among developers, investors, and policymakers, further slowing the adoption of PtG technologies (Preston et al., 2020).

While market opportunities and risk allocation are critical barriers, policy remains the most fundamental enabler for PtG adoption. A supportive and stable policy environment is essential to address these barriers by fostering market opportunities, reducing risks, and encouraging investment. Coordinated efforts to develop clear regulatory frameworks, invest in hydrogen infrastructure, and incentivize innovation will be crucial to overcoming these challenges. Financial incentives, such as subsidies or tax breaks for PtG infrastructure, could provide the stability needed to attract investment. Harmonizing regulations across regions and countries would reduce uncertainty and enable the development of larger, interconnected hydrogen markets. Additionally, fostering innovation in PtG technologies, particularly reversible systems, and integrating them with other energy solutions could enhance their economic and operational viability.

As highlighted by several interviewed experts, creating a stable and supportive environment for PtG technologies is essential to unlocking the potential of PtG technologies as a cornerstone of the global energy transition (Llera-Sastresa et al., 2020).

The introduction of PtG technologies in the energy market implies processes similar to those needed for innovative renewable technologies in the past. It should be noted that most of the resources attracted by investments in renewables were applied to mature technologies closer to grid parity (Masini and Menichetti, 2013). Thus, as PtG systems are innovative renewable technologies, they could fail to attract the capital necessary for the more significant upfront investments they usually

require. In the long run, the strategy of privileging relatively mature technologies applied to renewables could stifle the development of technological breakthroughs if large amounts of funds are required.

2.1. Institutional theory and sustainable energy technologies

This applied study aims to enhance the knowledge of how financial resources can be a vital link for the energy transition. The applied analysis draws somewhat on institutional theory, which other authors have applied to the energy transition (Lockwood et al., 2017).

Institutional theory considers governance, transactions, firms, markets, networks, policies, law, and other policy instruments. Studies are drowned in institutionalism to interpret phenomena in the energy sector because of the essential role of governments in changing energy use technologies and behaviors in a relatively short time for a global low-carbon transition (Andrews-Speed, 2016). Complying with the Regulation provides legitimacy to organizations, ensuring access to resources and their survival (DiMaggio and Powell, 1983). The business scholars' position, such as Escobar and Vredenburg (2011), indicates that energy industries' response to sustainability pressures would not be voluntary, but rather a somewhat coercive pressure from the regulators that leads to compliance isomorphism.

Based on this premise, among the three mechanisms of isomorphisms on which institutional changes occur, as defined by DiMaggio and Powell (1983), we consider that the coercive position applies to energy transition for PtG because formal and informal pressures are exerted on organizations by institutions. Coercive isomorphism can be used with those manufacturers when adopting new government rules established to combat pollution.

There is, therefore, some interplay between the requirements of the regulatory environment (coercive pressure) and the need to design systems to maintain efficiency and remain competitive (Tsamenyi et al., 2006). As sustainable development institutional influence varies according to the idiosyncrasies of each industry (Escobar and Vredenburg, 2011), regulation for climate change, renewables policies, and incentives for social investment are considered critical factors for our study in sustainable technologies such as PtG.

Based on these arguments, our first research question (RQ1) aims to expand knowledge about institutional influence through various mechanisms to foster a zero-emissions energy scenario.

2.2. Specific financial resources

Companies could be motivated by policies aimed at achieving particular objectives that materialize in monetary policies by developing fiscal regulations to promote them, and by other external factors, such as the structure of the financial markets in which companies operate (Rajan and Zingales, 1995). Thus, institutional factors can affect the companies' financial structure in a particular country or region (Palacín-Sánchez et al., 2013).

Inaccessibility to financial resources can be an obstacle in any investment decision (Fazzari et al., 1988). The availability of financial resources can influence the decision-making process concerning investments in innovation (Mann, 2018). Facilitating investment in as-yet immature technology projects for the transition towards a zero-emissions energy scenario requires investment in R&D. Thus, the initial outlay associated with this type of investment means higher amounts than those required in developed technologies (Luo et al., 2021). This more significant investment effort implies a greater need for suitable financial resources for the company.

The high volume of resources that need to be mobilized for the investment in PtG entails a significant restriction on this technology (Llera-Sastresa et al., 2020). These restrictions are mainly due to the need for disbursements that must be made before the plant is operational. In addition to the complexity of these technologies for replacing fossil fuels with a longer investment time horizon, the level of risk

related to investments in sustainable technologies is higher than for traditional projects (Ghisetti et al., 2017; Hamilton and Zindler, 2016). Even though investors demand additional returns to compensate for the higher level of risk, sustainable technologies could be a barrier for those investors with a moderate risk profile who ultimately show no interest in participating in projects with similar exposure.

The difficulty in accessing traditional financing tools through banks and even financial markets limits the development of high technological innovation. Therefore, it is necessary to rely on mechanisms better adapted to the risk assumed in innovation projects, which involve high technological development and high added value, such as venture capital (Lyasnikov et al., 2017; Yu et al., 2024). In these cases, investors align themselves with the timelines and outcomes of the financed project.

Government policies, such as fiscal incentives, direct subsidies, or low-interest loans, contribute to private investment in R&D (Montmartin and Herrera, 2015) and green innovation (Duan et al., 2024). Policies could contribute by mitigating risks, reducing costs, and increasing the expected return on investments in innovative technologies, thereby generating a competitive edge. The combination of government policy and financing through capital markets proves helpful in accelerating sustainable development and alleviating the burden on limited public financial resources (Wu et al., 2020).

The profitability and associated risks of innovation projects influence access to external financing. Innovation requires significant long-term capital needs, and the risks associated with these projects impose financial constraints that can limit resource allocation toward innovation activities. This challenge, in turn, may affect companies' willingness to engage in innovation, including those with specific environmental characteristics (Moshirian et al., 2021; Yang et al., 2025).

Significant resources can also be mobilized from the private sector, not only through loans but also from financial markets. Green finance, particularly green bonds, is a mechanism for channeling financial resources to undertake projects characterized by environmental protection (Razzaq et al., 2021). Funds from this type of emissions must be allocated to investment projects for decarbonization, which is why it plays an essential role in promoting renewable energy sources (Li et al., 2022) to the extent that the funds obtained from this type of emissions are used to develop clean energy infrastructure (Tian et al., 2022).

High-risk, high-reward innovative technologies, such as new energy technology projects, involve greater risk and uncertainty. These risks are not only due to technological complexity but also to the absence of a historical track record for planning future scenarios regarding their profitability (Roper and Tapinos, 2016). Thus, the motivation for its development could be weakened (Wu et al., 2020). This uncertainty increases financing costs, which impact the cost of activities, and may reduce companies' capacity for innovation (Dong et al., 2024; Yang et al., 2025). Furthermore, innovation activities are intangible assets whose value is limited as collateral for financing (Brown et al., 2009).

In this scenario, green financing, in the form of green bonds, provides the resources that allow for the promotion of investment continuously and over the long term, overcoming capital restrictions (Wang et al., 2023) that can affect investments in sustainable technologies, as with PtG. In addition, the financing mechanism serves as a risk-sharing channel among investors (Moshirian et al., 2021) and channels long-term financial resources to undertake projects characterized by environmental protection (Dong et al., 2024; Razzaq et al., 2021).

From another perspective, the social perception of the benefits and risks of new energy technologies can influence citizens' acceptance and support (Schnuelle et al., 2019). This perception can also attract the investors needed to meet the capital needs required by these projects. On the other hand, the information obligations required by this type of bond make it possible to reduce information asymmetry, which in turn can lead to lower costs (Jankovic et al., 2022; Li et al., 2022), as well as to expand and diversify financial sources, which allows for mitigating the asymmetry.

Knowledge about applying resources to finance these investments is critical for the companies investing. Assessing financial resources is also necessary for planning the specific resource mobilization involved in the transition towards a zero-emissions energy scenario and the circular economy, as well as to adapt the channels and facilitate the flow of resources for the energy transition. Based on these arguments, our second research question (RQ2) aims to expand knowledge about financial resources for sustainable energy technologies: Which financial resources can be mobilized for PtG in a given territory, and how are they prioritized in financing investments for PtG?

2.3. Definition of the social impacts of investments in PtG and reporting

The growing number of environmental requirements established by international climate change agreements has led to a body of literature focused on the green initiatives adopted by private companies operating in different sectors and their impacts, particularly in manufacturing industries and related sustainability practices (Chen et al., 2023).

Over the last few decades, trends in sustainability disclosure and reporting practices have revealed a significantly increasing number of standalone reports, including economic, environmental, and social information, particularly in the largest companies (Cho et al., 2012; Michelon et al., 2015; Orazalin and Mahmood, 2018). However, the social dimension of sustainability reporting is still developing (Kühnen and Hahn, 2017), especially concerning standardized indicators of all companies' social impacts, even though companies provide reports regarding employees, gender, equal opportunities, and more. Indeed, the existing frameworks to select social indicators frequently fail to be valuable and applicable to corporate sustainability (Blohm and Dettner, 2023; Boukherroub et al., 2015; Gualandris et al., 2015).

In energy innovation, measuring the social impacts of green investments in the sector is still understudied. The environmental dimension of sustainability generally prevails, with fewer social considerations (Kirchherr et al., 2017). This tendency led to a third research question (RQ3): How can the main socio-economic and social impacts of investments in PtG be measured?

3. Case study methodology

The method applied to this research is essentially qualitative due to the topic of this study being part of a research project for dimensioning PtG technologies in Spain in the medium term (Llera-Sastresa et al., 2020). The first part of the research was extended to a second approach, more specific to the definition and internal measurement of financial resources for PtG and the related impacts. This second approach was carried out through a qualitative methodology, including interviews with "semi-structured" questions and a Likert scale rating from the respondents in a specific financial institution. The semi-structured interviews align with other studies of sustainable technologies (Llera-Sastresa et al., 2020).

The interviews were carried out with experts and professionals in the energy field about the implementation of hydrogen technologies throughout the supply chain, and dealt with the following topics.

- (1) Adoption of PtG technologies, maturity, and penetration.
- (2) Barriers and drivers for these technologies, and financial resources for their deployment.
- (3) Definition and measurement of socio-economic impacts caused by investment and institutional aspects.

Detailed questions are based on desk research to synthesize the estimation of the impacts of these technologies in Spain and were adapted from those proposed by other authors (Korhonen et al., 2018; Smol et al., 2017). More specifically, impacts for PtG were captured from previous studies on these technologies when available or related to closed topics such as renewables or technology innovation.

(Llera-Sastresa et al., 2020; Valero-Gil and Scarpellini, 2024). The study of König et al. (2018), who analyzed socio-ecological impacts on existing local infrastructure, and the results obtained by Parra et al. (2017) provided the basis for PtG's costs, feasibility, and the environmental impact improvements generated by these technologies. Furthermore, impacts applied to the generation and distribution of renewables were considered (Scarpellini et al., 2021). Specific social impacts were adapted from those indicators used by another author for similar studies focused on circular economy innovation (Aranda-Usón et al., 2024).

In this study, 15 interviews were obtained and recorded, with an average duration of approximately 20 min. They were conducted in person or online with the interviewees, and the selected experts received the full text of the questions in advance. We collected data through this instrument, stating that semi-structured interviews allow for in-depth research into underexplored topics (Milman et al., 2023). The type of interviews conducted in this research enables the exploration of our research objectives (Aguinis and Solarino, 2019; Pratt, 2009). The number of interviews achieved in this study is considered suitable in line with other authors, such as Vélez-Ramírez et al. (2022), who performed 13 interviews. A lower number of 8 was considered appropriate by Kamal and Abu-Hijleh (2022). Mundaca and Kloke (2018) based their results on 12, while 18 interviews were carried out by Chung and Xu (2020). Thus, we consider our study sample suitable because it includes highly skilled experts in specific technical topics and represents public and private stakeholders.

To obtain information, approximately 50 % of the interviewees represented the public sector: R&D institutes, public authorities, or other public or not-for-profit organizations related to developing PtG technologies. The other half of the experts were from the private sector: utilities, companies, and experts related to the energy sector. The list of experts includes a brief description of the experts' profiles in Table 1, but owing to confidentiality agreements with the interviewees, their identities remain anonymous.

The list of experts was drawn up by the researchers participating in the project in collaboration with a representative of the Regional Government based on representativeness in the sector and availability for interviews. Dealing with potential bias when selecting experts for research is essential to ensure the objectivity of the findings. A minimum knowledge related to PtG technologies was required to minimize bias

when selecting the interviewees, and the general criteria of diversity in expertise and perspectives were applied based on previous studies that adopted a similar approach for interviews (Aranda-Usón et al., 2024). To avoid a narrow perspective and encourage critical thinking from different viewpoints, both R&D representatives and SME renewables companies are represented, as the level of implementation of the PtG still requires R&D and public support, as well as specialized companies in the region.

Our study focuses on the questions in the hybrid interviews detailed in Table 2.

The semi-structured responses are assessed in aggregate using a qualitative text and frequency method. The responses to the questions through the Likert scale were collected on a scale from 0 to 5 (where 0 means total disagreement and 5 means total agreement with the statements made). The variables were considered in three groups (blue, green, and grey) corresponding to the three research questions.

As a second methodological approach, we summarized the perspective of financial institutions in the support provided to sustainable investments through collaboration with a Spanish financial institution. This case was selected because of its willingness to provide access to data and the necessary collaboration to conduct the research. Its name cannot be disclosed for confidentiality reasons; we refer to it as the entity in the rest of the study. Through interviews with the institution's managers, specific information was obtained about which investments in PtG technologies are financed and how they are implemented.

4. Main results and implications

4.1. Main results

As a first step in the study, Table 3 shows the responses obtained for the first group variables in response to the first research question (RQ1).

Regarding the role of institutions and legislators in the deployment of PtG technologies, it was observed that experts consider public authorities encouraging investments through public funds and grant programs (FUND) to be a very important factor in obtaining higher mean values. Similarly, R&D is also considered a necessary factor (R&D) because it can promote substantial change in industry legislation that would encourage PtG.

By considering the second group of questions (RQ2), a more significant difference can be observed in the opinions provided by the interviewees regarding the financial resources mobilized for investments (Table 4).

The incipient phase of these investments was reflected in the low score obtained in the first question in Tables 4 and in which the informants expressed their opinion that the companies are still making a limited investment (INVP). This consideration is confirmed by the following two questions, which show that investments are limited by the difficulty in obtaining finance for these technologies (FIN) and the high initial investment required for their installation (VOLIN).

Table 4 also summarizes the opinions collected about financial resources for investments. It can be observed that the most critical resource is currently external debt instrument financing (LOAN), provided through commercial banks or similar and traditional sources of debt, with a lower score being achieved for public funds (REIMB), either in the form of a reimbursable loan or a grant. The company's resources (OWNF) have similar score levels to financing from foreign investors, which is less critical (EXT).

In addition to the above results, in response to the second research question (RQ2), we assessed financial resources using each interviewee's ranking (Table 5).

As seen in Table 5, external financing, channeled through loans obtained through credit institutions, is the most important source in the current phase. The second level of importance is public funds and reimbursable loans, while own and foreign funds are in third place. Table 5 summarizes the results obtained from a mixed question that

Table 1
Profile of the experts selected as key informants.

Type of organization	Entities	Profiles
Public sector: administration, R&D institutes, and other non-profit organizations	R&D Institute in the energy sector	5 engineers, 2 scientists, 1
	R&D company specialized in hydrogen	economist, 6 men and 2 women
	Regional Government of Aragón	
	Local administration	
	NGO environmental field	
	R&D Technology Institute	
	R&D Institute - hydrogen sector	
	University	
	Firm specialized in administrative law	5 engineers, 1 lawyer, 1 other, 5 men and 2 women
	SME: Installation and design of renewables	
Private sector: Utilities, industries, private companies that operate in the energy sector, and professionals	Electricity supplier	
	SME Installation and design of renewables	
	SME installation company	
	Utility renewables	
	SME Installation and design of renewables	

Table 2

List of questions and variables raised in the interviews and related variables (variables in blue are related to RQ1; variables in grey are related to RQ2; variables in green are related to RQ3).

Questions	Type	Variable
Do you consider the investment in internal R&D or collaboration with R&D Centers important in order to implement PtG technologies on a large scale? (code A.3_R&D)	Mixed: open and Likert	R&D
To what extent is Regulation a barrier for these facilities? (code Bb01 REG)	Likert	REG
To what extent would a substantial change in industry legislation encourage PtG? (code Bi01 LEG)	Likert	LEG
To what extent would grants/public funds encourage PtG? (code Bi05 FUND)	Likert	FUND
In your opinion, what investments are companies making to promote the implementation of PtG technologies in Spain? (code A4 INVP)	Mixed: open and Likert	INVP
To what extent is difficulty in obtaining finance a barrier to its installation? (code Bb 05 END)	Likert	END
To what extent does the high volume of initial investment hamper this technology? (code Bb 10 VOLIN)	Likert	VOLIN
Taking into account the investments necessary for the implementation of PtG technologies in Spain, prioritize the sources of finance that companies will use as a priority in the coming years, and assess their current importance: B.3a Own Funds B.3b Repayable loans and public aid B.3c Financing from credit institutions or similar B.3d Foreign funds Others	Mixed: open, prioritizing, and Likert with an open option	RESO B.3a-B.3d
Evaluate the impact of investments in hydrogen and PtG on the following aspects: C.1_DIST "General interest in distributed energy generation." C.2_VALUE "Improving the value of the company." C.3_SAVE "Savings on the energy supply bill." C.4_DEPELE "Avoiding dependence on electrical supplies." C.5_DEPFOS "Avoiding dependence on fossil fuels Others (specify)	Likert and open option	C.1-C.5
Rate the importance of the following social impacts of investments in hydrogen and PtG in the next 3-5 years: C.6 Generation of new jobs in Spain C.7 Demand for new professional profiles C.8 Positive impact on society in general C.9 Tax collection C.10 Improvement of public health through environmental improvements	Likert	C6-C10
Indicate the main socio-economic impact of the implementation of PtG technologies on the following three factors	Structured	C.11

Table 3

Opinions of the interviewees about the first group variables on institutional influence on the PtG deployment.

Likert	R&D	REG	LEG	FUND
0	0	1	0	0
1	0	0	0	0
2	1	1	1	0
3	3	4	2	2
4	6	4	8	6
5	5	5	3	7
NA	0	0	1	0
AVERAGE	4,0	3,7	3,9	4,3
MEDIAN	4,0	4,0	4,0	4,0
MODE	4,0	5,0	4,0	5,0
SD	0,93	1,40	0,83	0,72

Table 4

Opinions of interviewees regarding the impact of variables in the second group on financial resources for investments in PtG.

Likert	INVP	END	VOLIN	OWNF	REIMB	LOAN	EXT
0	4	0	0	0	0	0	0
1	3	1	1	1	0	0	2
2	2	1	2	3	4	2	3
3	3	2	1	4	3	2	2
4	1	8	7	3	5	5	5
5	2	1	2	3	2	4	1
NA	0	0	0	0	0	0	0
MEAN	2.0	3.5	3.5	3.3	3.4	3.8	3.0
MEDIAN	2.0	4.0	4.0	3.0	3.5	4.0	3.0
MODE	0.0	4.0	4.0	3.0	4.0	4.0	4.0
SD	1.77	1.05	1.20	1.27	1.08	1.07	1.29

Table 5

Prioritization of financial resources provided by the interviewees and the current feasibility of financial resources for investments in PtG (based on times scored in each position of feasibility).

Relevance of financial resources by the total score obtained (Likert scale from 0 to 10)		Ranking				Order
		N° Most feasible [4 points]	N° Medium-high feasibility [3 points]	N° Medium feasibility [2 points]	N° Least feasible [1 point]	
B3c_LOAN Loans or external financing	99	4	4	5	0	38
B3b_REIMB Payable loans and public funds	47	3	3	5	3	34
B3a_OWNF Own funds	46	2	4	2	6	30
B3d_EXT Foreign funds	39	5	3	1	4	35

includes open answers, a prioritizing scale (1–4), and a Likert scale (from 0 to 10) to rank the financial resources based on their relevance for PtG investments and reflect on their current feasibility and availability for these investments.

For the prioritization of the different types of resources that companies will use as a priority in the coming years, six experts ranked their funds for implementing technology in the lowest position, probably due to the high amount of investment projects. The incipient phase of technology development prevents the resources generated internally by companies from being sufficient for financing requirements, adding that the higher level of risk associated with these investments is a barrier to attracting capital at a suitable cost.

Concerning investments, it is considered that companies will, above all else, resort to external financing from credit institutions or similar. Foreign funds interested in financing companies developing sustainable energy technologies appear in second place in the ranking, and their prioritization is similar to public funds at the other two intermediate levels. This finding possibly points to large companies that may find it easier to diversify the risk associated with investments in sustainable energy technologies due to scale and accessibility to the necessary channels and financial resources.

In response to the RQ2, the results indicate that renewables should be used in hydrogen-related technologies, like PtG, that currently rely on fossil fuels. Subsequent growth will come from using hydrogen in other industrial processes as an energy source for transport and generators and a power source for heating systems. The idea is that the final demand for hydrogen can be multiplied by ten between now and 2050 in Spain. Demand for financing is predicted for electrolyzers, hydrogen fuel cells, and hydrogen cell generator manufacturers.

As a result, some listed companies can also play an important role in this transition within energy portfolios exposed to the PtG value chain, such as electrolyzer manufacturers or investors in hydrogen exploitation. Deep knowledge of the business (such as production, hydrogen network, and customers) puts companies in an ideal position to take advantage of the growth in demand for these energy sources.

Their expertise and ability to raise funds on financial markets allow them, on the one hand, access to new financial instruments in the field of green financing, allowing them access to significant volumes of resources to finance projects aimed at developing sustainable technologies infrastructures, as is the case of PtG, where the information and transparency requirements are very demanding, which contributes to reducing the risks derived from information asymmetry. On the other hand, they influence the social acceptance and perception of technology by attracting new investors, allowing them to diversify, strengthen, and expand the portfolio of available financing sources.

Financial institutions are looking at these technologies and companies' strategies because the valuations are demanding. For commercial banks, there is no clear distinction between hydrogen technologies

because practically all the companies involved in the production of RES are studying joint generation-electrolysis-commercialization projects and are already included in the energy portfolios.

In the third group of questions (RQ3), the interviewees' opinions about the type of impact derived from the investments in PtG are distributed among the three pillars of sustainability. A higher percentage was given to the environmental impact (43.57 %), which decreases the economic impacts (31.07 %), making it clear that the social impacts are less important (25.36 %) in the opinion of the experts. In this regard, it should be noted that social impacts are challenging to measure, and this category is traditionally the least developed of the three in terms of sustainability.

We answer the third research question (RQ3) by considering the opinions of the interviewees about the importance of the leading impact categories for PtG. Interviewees considered the reduction in fossil fuel dependence to be very important (C5 DEPFOS), obtaining the lowest average value in cost savings for energy supplies (C3 SAVE) due to the current high cost of these technologies (Table 6).

Fig. 1 shows the total scores obtained for each impact category, the lowest being the one given to the valuation of the companies that make the investments.

The opinions of the interviewees for these categories are similar for the two profile groups (Fig. 1), with the scores provided by private sector representatives being higher. According to these results, institutions could address utilities' investments in PtG through public funds and grants that are still considered relevant in this phase of the technology deployment. A legislative framework to reduce energy dependence could positively influence investments. Promoting collaborative R&D is another relevant factor to be considered to increase the institutional influence for PtG deployment (RQ1).

Specific social impacts linked to investments in PtG are summarized in Fig. 2 to enhance knowledge in response to the RQ3.

The two categories of social impacts that are considered most

Table 6

Opinions of interviewees regarding the impact of variables in the third group on socio-economic impacts for investments in PtG.

Likert	C1_DIST	C2_VALUE	C3_SAVE	C4_DEPELE	C5_DEPFOS
0	0	0	0	0	0
1	1	0	1	2	0
2	0	1	0	0	1
3	4	4	7	5	1
4	7	8	4	7	5
5	3	1	3	1	8
NA	0	1	0	0	0
AVERAGE	3,7	3,6	3,5	3,3	4,3
MEDIAN	4,0	4,0	3,0	4,0	5,0
MODE	4,0	4,0	3,0	4,0	5,0
SD	1,03	0,74	1,06	1,11	0,90

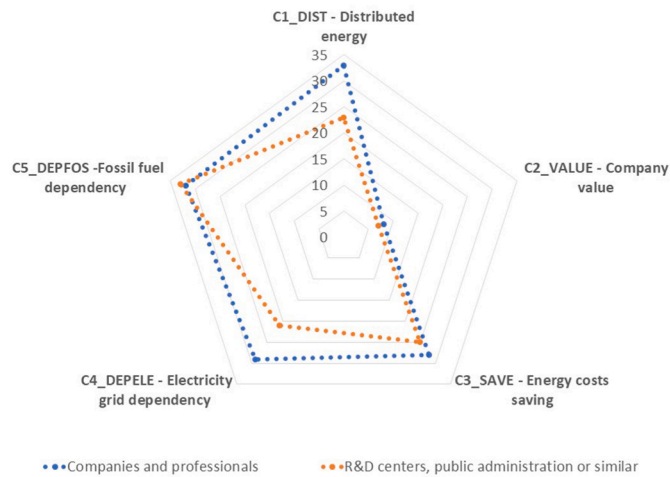


Fig. 1. Assessment of impact categories related to investments in PtG based on the two groups' profiles of the interviewees.

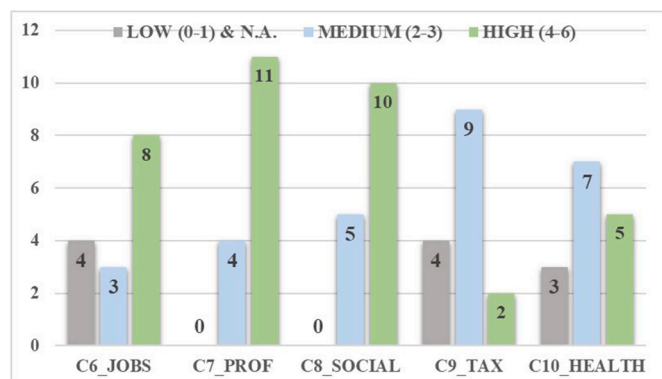


Fig. 2. Interviewee assessments concerning categories of social impacts of investments in PtG.

important are the demand for new professionals (C7_PROF) and the positive impact on society (C8_SOCIAL), followed by the impact on employment, which is considered reasonably necessary, in third place (C6_JOBS). The positive impact on public health is considered less important (C10_HEALTH), with these investment impacts on tax collection being in last place with a lower score (C9_TAX). For these categories, the opinions of the different interviewees' profiles do not change significantly (Fig. 3).

The different opinions, depending on the profile of the interviewees, can be seen more in the variables inherent to investments and financial resources, with the scores provided by company representatives being higher. The most significant differences are observed in interviewees' perceptions of the importance of external financing (LOAN), with the higher value given by business experts being pronounced. However, the other marked difference is observed in the opposite direction, as the level of investment to implement PtG technologies (INVP) is considered more significant in the case of interviewees from public administrations, highlighting that it is not the volume of investment that limits this technology, but rather the availability of resources (LOAN and EXT).

Although some of the responses obtained may seem expected, they allow us to verify these approaches to the object of the research through the opinion of different experts on a subject that is still little explored, such as financial resources for investments in PtG. In addition, these results provide insight into the most important social impacts and a first view of the indicators to be used for reporting by companies undertaking this type of investment, since information of this type is not usually accessible and differentiated.

4.2. Brief remarks on a theory and practice context

No similar interdisciplinary studies have focused on mobilizing financial resources specifically applied to PtG technologies. Thus, the scope of discussion may be limited. However, the following paragraphs look at some general aspects regarding results obtained in managing financial resources and measurement for reporting impacts derived from investments as a line of inquiry into sustainability accounting.

In this study, institutional theory has been considered based on the incipient implementation phase of PtG technologies, being conditioned and driven by institutions (sustainability) and the market (security of

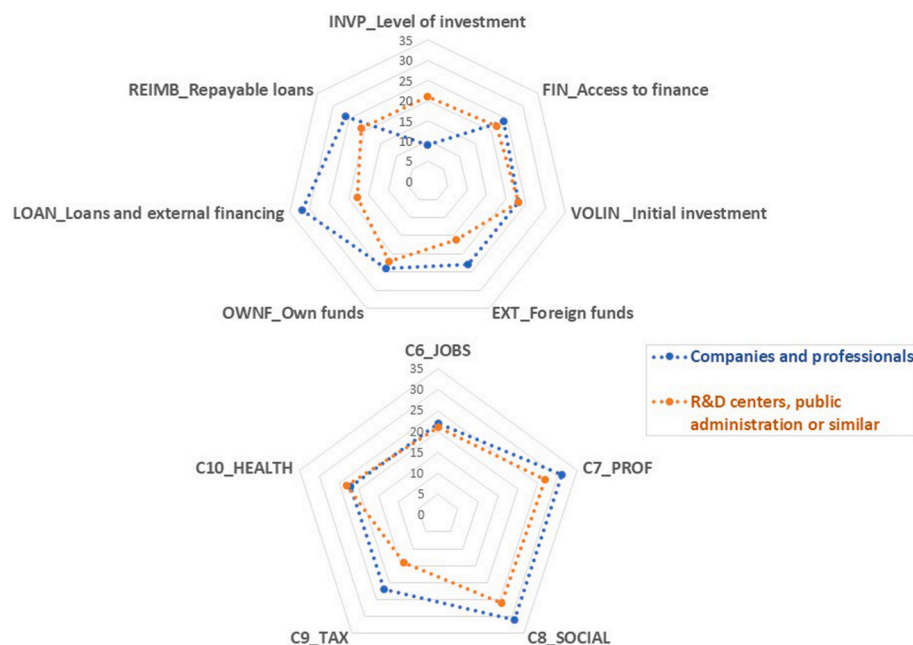


Fig. 3. Assessment of financial resources and social impacts based on the profiles of the interviewees.

supply). The coercive environment currently promoted by the institutions would explain a mimetic isomorphism proposed by Escobar and Vredenburg (2011) for this sector. Competitors can invest in similar strategies without institutional promotion measures if technology matures in a competitive environment. This approach is consistent with the institutional explanation of coercive isomorphic pressure studied by Tsamenyi et al. (2006). Considering the pressures of the current environment, we can say that the conditions for institutional isomorphism are still not favorable for management accounting practices, as suggested by Vailatti et al. (2017). As Scapens (2012) states, all three types of institutional theory emphasize that institutions matter and have made significant contributions to sustainability accounting research, especially research into environmental management accounting change processes.

In Europe, the financial sector is strongly institutionalized, and the weight of financing through loans granted by financial institutions is widely entrenched (Polzin and Sanders, 2019). The importance of this type of financing in the incipient phase of investing in sustainable energy technologies and during implementation and start-up would indicate that barriers to access to these types of resources could be exceeded by the companies that are positioned to undertake a project of these dimensions and could be a more attractive source of resources than the use of their own funds.

However, it is necessary to highlight the limitations to which this alternative is exposed in terms of amounts, terms, and risks. These are projects of significant volume, competing simultaneously for limited financial resources provided by financial institutions that must balance the maturity of their liabilities with investments that have a long-term horizon, great technological and industry complexity, and in the face of a rising interest rate scenario, which increases the credit risk associated with the project.

When financing needs for the implementation of the technology increase, they are expected to be met by attracting foreign funds, which is in line with what has been indicated by Fernández Gómez and Basterra Larrea (2021). In exploiting sustainable energy technologies, investors would prioritize different resources in the initial phase of the investment, and those resources are needed primarily in the medium term for the implementation and start-up of the facilities.

There is no doubt that some challenges are still open in this topic. O'Reilly et al. (2024) state that it would be valuable to examine other European countries to assess cultural differences in environmental practices and the ability to implement the EU Taxonomy in other countries. Nevertheless, under the requirements of the international standard, our results could be applied to other EU members as a baseline to measure the social impacts of investments in PtG and energy-sustainable innovations. As Garcia-Torea et al. (2024) suggested, policymakers and enforcers should offer clear guidance for the EU Taxonomy to design the implementation coherently and harmonize with other regulations to improve regulatory certainty.

As Canfora et al. (2022) suggested, the EU Taxonomy does not explicitly require any formal assurance of whether activities comply with the technical screening criteria, and national supervisors are called to monitor compliance with the taxonomy disclosure obligations. However, in our study, we refer to the project-level investments suggested by Schütze and Stede (2024) and Tettamanzi et al. (2023). Thus, these results could be extrapolated to similar projects for sustainable energy sources in other EU countries in line with the results obtained by Lucarelli et al. (2023).

For financial resources, we expand the results of O'Reilly et al. (2024) regarding the relevance of the lack of resources. We also partially corroborate Papari et al. (2024) concerning the EU Taxonomy about the strong presence of public actors for PtG and a high incidence of public co-financing. Our study indicates the need for upscaling investments in these technologies through higher private funds, green bond availability, and their explicit inclusion in the PtG investments.

5. Conclusions and policy implications for utilities

This paper presents interdisciplinary research explaining how financial resources are mobilized for PtG technologies in the EU and the related social metrics for reporting in the framework of the institutional influence for the transition to a zero-emissions scenario.

In response to the first research question, this study provides theoretical and practical insights regarding current and future energy policy for PtG regarding sustainable finance policies. Policymakers can use these reflections to assess the institutional influence that PtG technologies entail. Regulators and promotion policies must consider the typology of financial resources and prioritization to foster these investments and the future enhancement of the rules proposed by the Taxonomy for sustainable investments in the EU. In particular, this study highlights the positive impact of public funds and grants in this phase of the technology deployment. In addition, legislation focused on reducing energy dependence can positively influence investments in PtG. Collaborative R&D is also deemed a relevant factor in increasing PtG deployment.

As the second main objective, this research provides a simplified application, prioritization, and arrangement of financial resources for practitioners to measure impact investing for sustainability. In addition, the differentiation of resources for sustainable investments makes it possible to define and measure the relative social impacts so that companies report them in light of requirements established by European rules for corporate sustainability reporting.

Diversifying funding sources and participants allows us to face unfavorable environments with greater resilience and the challenges faced by technology, as well as benefit from lower costs and greater stability in the financing process. Therefore, while policies are promoted broadly to encourage significant investments that drive decarbonization, we must continue supporting less fragmented and developed capital markets to benefit smaller companies.

Understanding social impact indicators related to investments in PtG facilitates reporting in a renewable and zero-emissions energy scenario within the EU standards and corporate sustainability reporting practices for utilities. Finally, this study contributes to the academic debates on the specificity of resources and how their value can trigger social accounting processes that can eventually result in structural management change.

The limitations of this exploratory study are mainly associated with the qualitative method and scope, which preclude generalizability. Although interviews are considered suitable for this study, the few experts in the specific field of PtG impacts and their limited availability limit the data collection. Interview protocols that include other highly skilled experts in this specific technical topic could enhance policy implications, including different countries and varied institutional factors influencing the PtG deployment. Our study is limited to Spain and cannot be applied *per se* to other countries without adaptation to the institutional context. However, the methodology can be adapted to other geographical areas.

We also acknowledge the limitations related to a case study, the findings from which cannot be extrapolated. Future research could expand the study to other countries and regions to enhance the generalizability and transferability of the findings. In addition, extending the size of the interviewees and adding more specific questions could help in designing specific policies.

Despite the difficulty of identifying experts for this type of research, the interviewees who responded to the requirements of the study offered a variety of profiles and critical thinking from different viewpoints to limit potential bias as much as possible. However, this framework does not allow for considering institutional pressure over time and does not elucidate change patterns across spatial and temporal contexts. Future studies should try to overcome the limitations of our contribution by expanding the number of case studies and their geographic scope, and by analyzing investments empirically at a more advanced implementation stage.

CRediT authorship contribution statement

Pilar Portillo-Tarragona: Writing – original draft, Methodology, Investigation, Formal analysis. **Eva Llera-Sastresa:** Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Sabina Scarpellini:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **Dario Benito-Bentue:** Writing – original draft, Validation, Methodology, Investigation, Formal analysis.

Declaration of generative AI and AI-assisted technologies in the writing process

While preparing this work, the authors did not use AI technologies, except for the final writing style review through the Grammarly application.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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6. Capítulo sexto. Conclusiones

6.1 Principales conclusiones

A partir del marco teórico y la sinopsis de la Tesis, se han aplicado distintas metodologías de carácter cualitativo que representan per se una de las aportaciones de esta Tesis al permitir un análisis inédito del nivel de introducción de la EC en el sector financiero desde la perspectiva de los *stakeholders* (Elalfy and Weber, 2019). Asimismo, se han definido de forma novedosa las prácticas de contabilidad medioambiental del sector financiero para medir y divulgar la EC y su relación con las inversiones sostenibles, dando cumplimiento tanto al Reglamento Delegado (UE) 2020/852 de Taxonomía de Inversiones Sostenibles, como al Reglamento 2019/2088 del Parlamento Europeo y del Consejo, conocido por las siglas SFDR.

De forma general, se hace patente la necesidad de aumentar y mejorar la información proporcionada sobre acciones y fondos específicos para inversiones en EC. El conjunto de análisis realizados sobre la implantación de la EC en el sector financiero, nos lleva a concluir que el grado de rendición de cuentas o *accountability* es insuficiente, especialmente en lo que concierne a modelos de servitización y modelos compartidos, en los que indudablemente el sector será participe en el corto y medio plazo. Efectivamente, las entidades financieras informan acerca de la reducción de residuos, la evolución de los consumos, el reciclaje y, en menor medida, acerca de acciones más propias de modelos circulares en actividad interna; pero no usan de forma habitual indicadores genéricos y específicos para la divulgación no financiera de la EC. En ese sentido, el trabajo realizado en esta Tesis aporta una contribución relevante al proponer indicadores concretos que los profesionales del sector puedan utilizar para incrementar su rendición de cuentas. Para ello, no obstante, se hace necesario un conocimiento más detallado de las inversiones, fondos y otras actividades relacionadas con el cierre de círculos de materiales. De hecho, los resultados obtenidos en el análisis de la información recabada y divulgada en el sector en cuanto a EC, nos llevan a concluir que, posiblemente, existe una brecha entre académicos y profesionales en cuanto a la medición de la EC, como refleja el entendimiento conceptual de los contratos de *renting*. Mientras los principales datos pueden ser aplicados por los administradores para definir y medir las mejoras ambientales específicas logradas mediante el fomento

de instrumentos convencionales, los académicos pueden analizarlos bajo el prisma de la circularidad.

La plasmación en datos cuantitativos del papel facilitador y multiplicador que tiene el sector financiero en cuanto a la implantación de la EC, es otra contribución principal de esta Tesis. Efectivamente, a menudo se ha puesto de manifiesto desde las instituciones que el sector financiero era clave para el fomento de la EC. No obstante, se hacía sin soporte académico o cuantitativo hasta que los resultados obtenidos en esta Tesis confirman y amplían cuantitativamente el efecto tractor del sector financiero. Extender el conocimiento sobre este impacto potencial, se hace importante no solo para las entidades financieras, sino también para sus partes interesadas, que pueden tomar decisiones informadas si conocen su impacto en la EC.

En los últimos años, estamos asistiendo a nuevas normativas y legislaciones que llevan a incluir y aumentar la información no financiera sobre las características de los productos de inversión, adaptándose así a las prácticas de divulgación y transparencia del Reglamento 2019/2088 del Parlamento Europeo y del Consejo, y del Reglamento Delegado (UE) 2020/852 de Taxonomía Europea de Inversiones Sostenibles. En ese sentido, es importante conocer si ello conduce a decisiones de inversión informadas que favorezcan la EC. La investigación planteada en esta Tesis nos lleva a concluir que dicha legislación y estandarización es insuficiente, y no está logrando su objetivo de fomentar decisiones más sostenibles. La falta de metodologías estandarizadas, de indicadores específicos y de información sobre el potencial impacto negativo de los productos financieros, limita significativamente el efecto de la legislación. Nuestras conclusiones, en este sentido, sugieren poca proactividad hacia la información de sostenibilidad y EC por parte de los fondos, y una motivación puramente coercitiva basada en el cumplimiento mínimo de la legislación, tal y como indica la homogeneidad en el comportamiento de las distintas organizaciones. Se hace necesaria una legislación más completa, detallada y clara, así como un mayor esfuerzo institucional para dar seguimiento al cumplimiento de la misma.

El impacto institucional, no obstante, también puede reforzarse y desarrollarse desde una aproximación positiva y de apoyo a las inversiones que tengan características

vinculadas a la EC y la sostenibilidad. En este sentido, podemos hablar de política financiera encaminada a priorizar las inversiones vinculadas a la Taxonomía de la UE, y a mejorar las reglas que la definen para hacerla más eficiente. A partir del estudio de un caso específico (*Power-to-Gas*), en esta Tesis comprobamos como los fondos y subvenciones tienen un notable impacto positivo para el despliegue tecnológico incipiente, así como influencia en factores transversales y no necesariamente tecnológicos como la dependencia energética y la soberanía sobre el consumo energético. De nuevo, concluimos que la información no financiera y, específicamente, sobre EC, favorece las inversiones más sostenibles, permitiendo a la vez la diferenciación de éstas a partir de los impactos sociales resultantes. Desde un punto de vista académico, estas conclusiones contribuyen al debate sobre la especificidad de los recursos y cómo su valor puede desencadenar procesos de contabilidad social que eventualmente resulten en un cambio estructural en la gestión.

6.2 Principales aportaciones desde el enfoque teórico

El marco teórico de la presente Tesis doctoral se ha articulado a partir de las principales teorías utilizadas en la literatura con relación a la rendición de cuentas aplicada a la sostenibilidad por parte de las organizaciones. Entre éstas, desde un enfoque normativo, destaca la teoría de los *stakeholders*, como marco clave para analizar el modo en que el sector financiero responde a la creciente demanda en materia de sostenibilidad y contabilidad medioambiental. En este sentido, a lo largo de la Tesis, se ha investigado sobre el impacto que la presión de los *stakeholders* tiene en las decisiones sobre *accountability* y divulgación no financiera por parte del sector financiero. Por otro lado, tomando como referencia los recientes avances en legislación y normalización de la obligatoriedad de presentar información no financiera, se ha investigado el impacto del isomorfismo coercitivo a partir de la teoría institucional o neo-institucional, que posiciona a las instituciones como verdadero motor del cambio.

Los resultados obtenidos en los distintos capítulos de la Tesis evidencian el interés legítimo de los *stakeholders* por conocer la información de sostenibilidad relacionada con los servicios y productos ofrecidos desde el sector financiero, y la creciente demanda de transparencia para poder tomar decisiones informadas en ese campo.

Consecuencia de dicha presión es el aumento en información no financiera y de sostenibilidad ofrecida por las entidades que no están obligadas a ello. Sin embargo, nuestras conclusiones ponen de manifiesto que la teoría de los *stakeholders* no explica completamente el comportamiento de dichas entidades puesto que no se han puesto los medios de medición y estandarización necesarios para que la información proporcionada sea útil, eficiente y oportuna. Como se deduce del estudio de la información sobre el *renting* y del estudio sobre la información acerca de los PAIs, la ausencia de indicadores apropiados y de formatos más exhaustivos, impide que la información proporcionada cumpla con su función para con los *stakeholders* a la que va dirigida.

Antes bien, y como confirman las conclusiones obtenidas en el estudio sobre la información proporcionada por los fondos de inversión, la motivación de muchas entidades en el sector financiero responde a una reacción pasiva y/o reactiva a las nuevas obligaciones impuestas desde las instituciones. La ausencia de métricas claras y detalladas en las normas impuestas, parece servir de justificación a las entidades financieras, sugiriendo que es el cumplimiento de la Ley, y no el deber hacia los *stakeholders* lo que guía sus decisiones de divulgación de información.

Agrupando las conclusiones que se desprenden de la Tesis a nivel teórico, podemos argumentar que, en la actualidad, el comportamiento de las entidades financieras en cuanto a divulgación de aspectos relacionados con la sostenibilidad, especialmente en cuanto a economía circular y medioambiente, responde sobre todo a la teoría institucional o neo-institucional, restringiendo el volumen y utilidad de la información al mínimo exigido por la Ley. Este argumento entronca con las ideas de Tsamenyi et al. (2006) o Vailatti et al. (2017), en cuanto al impacto de un isomorfismo coercitivo, que marca la agenda de las instituciones. Este comportamiento, por otra parte, puede explicarse por el carácter fuertemente institucionalizado del sector financiero en Europa, así como su naturaleza tradicional y conservadora. En todo caso, aún existen desafíos vinculados a la comunicación efectiva de los impactos medioambientales hacia los *stakeholders*, que requieren mejorar los estándares de reporte y la comparabilidad de la información divulgada.

Entre las entidades financieras no sujetas a las normas de información no financiera, ya sea por tamaño o por no considerarse de interés público, la práctica de divulgación de información de sostenibilidad observada en los capítulos de la tesis presente, sugieren un acercamiento mixto, marcado por el deseo de responder al deber de comunicación hacia los *stakeholders*, por un lado, y al de emular el comportamiento de las grandes organizaciones del sector, por otro. Esta observación, que se pone de manifiesto en el capítulo sobre los aspectos financieros en la implantación de nuevas tecnologías PtG, apunta a un isomorfismo mimético, en línea con Álvarez-Etxeberria et al. (2023), siempre en el ámbito de la teoría neo-institucional, pero con un mayor enfoque normativo.

6.3 Implicaciones derivadas de la Tesis, limitaciones e investigaciones futuras

Los resultados de esta Tesis doctoral contribuyen al sector financiero y bancario en materia de regulación y transparencia, identificando la necesidad de mayor transparencia en la divulgación de inversiones sostenibles dentro del sector financiero, en respuesta a la Taxonomía europea de inversiones sostenibles. Proponemos que las entidades financieras deben desarrollar e incrementar la medición e información sobre las inversiones que contribuyen a la sostenibilidad, incluyendo iniciativas de EC como el reciclaje, la reducción de emisiones y el consumo de recursos sostenibles. Por otro lado, mostramos que la integración de productos financieros como los modelos de *leasing* y *renting*, pueden ser herramientas clave para fomentar la EC dentro del sector financiero. Además, se pone de manifiesto cómo los bancos pueden fomentar inversiones sostenibles a través de nuevos productos financieros, como fondos de inversión en energías renovables y financiamiento para infraestructura verde.

Las contribuciones dirigidas a los organismos reguladores destacan la importancia de desarrollar estándares y métricas específicas para que las instituciones financieras puedan reportar con eficacia y utilidad sobre la sostenibilidad de sus inversiones. Se resalta la necesidad de estudiar cómo la regulación existente, en especial la taxonomía de la UE, está siendo implementada por las instituciones financieras y cuál es su impacto real. Por último, se recomienda que los reguladores supervisen más de cerca

las estrategias de EC dentro del sector financiero y se fomente la adopción de prácticas sostenibles.

La primera limitación inevitable es la falta de datos homogéneos sobre sostenibilidad debido a que la información proporcionada por las entidades financieras es dispar y no sigue criterios uniformes, lo que dificulta la comparabilidad. Aunque en la presente tesis hemos tratado de solventar esta limitación homogeneizando la información, se propone el desarrollo de metodologías estandarizadas y métricas basadas en indicadores GRI y la Taxonomía europea de inversiones sostenibles.

La segunda limitación se deriva de la dificultad en la implementación de modelos circulares en el sector financiero debido al conocimiento insuficiente sobre la relación entre EC y financiamiento sostenible, lo que ha podido ser un obstáculo para la adopción de estrategias como el *renting* y el *car-sharing*. Como línea de investigación a seguir, en ese sentido, se propone desarrollar modelos que permitan incorporar los modelos circulares en los informes de sostenibilidad y educación interna en entidades financieras.

Una última dificultad para encontrar información útil, es consecuencia de la baja integración de los principios de la EC en las estrategias de las entidades del sector financiero. La mayoría de las entidades aún no vinculan explícitamente sus prácticas de sostenibilidad con la EC. Esta limitación se ha soslayado, en gran medida, con entrevistas y encuestas personalizadas, que nos han permitido trasladar los conceptos esenciales de la información sobre la EC a los directivos de las entidades participantes.

Por último, la Tesis permite abrir nuevas líneas de investigaciones futuras. En primer lugar, la evaluación a largo plazo de la regulación en materia de sostenibilidad. Se propone realizar estudios sobre cómo la regulación de la UE en inversiones sostenibles afecta al comportamiento del sector financiero en el largo plazo. En segundo lugar, permite avanzar en el análisis del desarrollo de nuevos productos financieros sostenibles. Para ello, se recomienda investigar la viabilidad de nuevos instrumentos financieros diseñados específicamente para fomentar la EC. En tercer lugar, una línea de investigación futura sería profundizar en el impacto del *renting* y *leasing* en la reducción de la huella de carbono debido a que se identifica como un área de

investigación emergente el analizar cómo los modelos de EC pueden contribuir a reducir el impacto ambiental de las instituciones financieras y sus clientes. Por último, la comparación de modelos regulatorios a nivel internacional es una línea de investigación que permite realizar estudios comparativos entre diferentes marcos regulatorios para identificar las mejores prácticas de regulación de finanzas sostenibles.

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