

## Responsible intellectual property strategy for sustainability transition - An exploratory study<sup>☆</sup>

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### ABSTRACT

In this paper, we propose a responsible intellectual property (IP) strategy (R-IPS) framework based on five exploratory case studies of sustainable companies in energy, nutrition, consumer electronics, manufacturing and water treatment sectors. These companies responsibly use IP assets to create positive social and environmental impact (or reduce negative impact), and unlock new opportunities for financial (economic) gains. The extent to which firms today use IP rights such as patents and trademarks, and IP more broadly (including informal intellectual assets such as data and trade secrets, and contracts) as a strategic tool to facilitate sustainability remains to be understood better. More specifically, we need understanding of how companies could, or even should manage and use their IP more responsibly in these changing times during which transitions towards sustainable development are so thoroughly and urgently needed. The proposed framework defined using five dimensions namely deliberation/intention, sustainability IP alignment, flexibility and timing, inclusiveness, and co-creation can support managerial decision-making in formulating or re-designing IP strategies to increase organization's social and environmental impact, maximising their contributions (e.g. accelerating transitions) towards building sustainable economies.

### 1. Introduction

To address global challenges, such as decarbonisation to achieve Net Zero, we need large-scale research programmes to develop and quickly diffuse sustainable innovations. Since the United Nation's Sustainable Development Goals (SDGs) launch in 2015, worldwide innovations ranging from technological and business models to policy-oriented ones thrive to address global issues such as climate change, poverty, inequality, and other SDGs [1–3]. Recently, the COVID-19 pandemic has highlighted and demonstrated the possibility of increasing the pace of research, development, and large-scale diffusion of innovations to address urgent global challenges [4]. While during the pandemic much

emphasis was on social-impact innovations (e.g. vaccines and personal protective equipment), we also need 'green innovations' [5] to address climate change and achieve decarbonisation goals. Those include, for instance, more environment-friendly technologies, products, services, and combinations thereof. Furthermore, we also need system-changing innovations, policy innovations and innovative business models that aim to mitigate environmental risks, such as through pollution control, emission reduction, energy-saving and waste recycling [6–8]. Digital (e.g. AI-based) sustainable innovations are likely to play a particular role for sustainability [9]. For instance, while Google has always been on the forefront of optimising its data centre's energy consumption, 'unleashing' Deepmind onto this problem has resulted in an additional energy

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reduction from what was thought to be already a heavily optimised system by about 40% [10].

Sustainability-oriented innovations (referred to hereafter as SOI) [11,12] expand the scope of innovation to include environmental as well as social and economic dimensions. However, several of these innovations involve complex intellectual property (IP) related challenges that potentially hinder their development and diffusion [13,14]. For instance, when the IP assets required for developing an invention with critical environmental or social benefit (e.g. COVID vaccine) have multiple organizational ownership, and the organizations are unwilling to share the 'crisis-critical' IP or license to an external entity for mass-producing the invention, then social benefit gets delayed or hindered (e.g. delayed vaccine development and diffusion in the case of COVID costing human lives) [4,15,16]. Another example, related to the circular economy are certain platform technologies, for which all actors need access to the relevant IP to jointly 'close' the circular economy loops. Such technologies might be called 'common purpose' technologies with associated 'common good IP'.

By IP, in this paper we refer to formal IP rights (IPR) like patents, trademark, and copyrights, and informal intellectual assets like know-how and data [17]. IPR has been an established policy instrument to incentivise innovation but using IP (including IPR) as a strategic tool to facilitate sustainability remains little understood. Despite the strong dependencies between IP and innovation, literature lacks an understanding of how companies should responsibly manage and use IP to govern innovations, especially technologies potentially supporting SDGs.

Based on case study evidence from five companies that have successfully developed and diffused sustainable innovations (referred to hereafter as sustainable companies), this paper provides insights into how these companies have used their IP responsibly to contribute towards sustainability. We identify, define, and describe five dimensions companies should consider when formulating responsible IP strategies, such as for helping to achieve SDGs. By IP strategy, we refer to the decision-making guidance of an organisation regarding the selection and combination of different 'IP models' to maximise value creation and capture in support of, and thus in alignment with the organisation's objectives. The notion of an 'IP model' refers to how an organisation controls the ownership, access and usage rights for a combination of relevant IP assets to achieve one or more specific objectives [18,19]. The choice of the IP models might very well depend on the actors, activities, artifacts, and institutions, and relations of the organization within and beyond its ecosystem [20].

We incorporate learnings from the responsible research and innovation (RRI) literature to understand an organization's strategic, but responsible use of IP. The theory of RRI provides guidelines for responsibly governing science and innovations through an interactive approach among relevant stakeholders taking into account societal expectations and future developments [21–23] but has not incorporated IP considerations, despite mentioning that IPR needs to be addressed [23]. Our investigation of the IP strategies of the five sustainable case companies studied as a part of the IPACST<sup>1</sup> project indicates the responsible use of IP for sustainability going beyond the traditional protective mindset and places emphasis on IP sharing for common good. This approach is evidenced commonly in the open innovation context, mainly using IP to trigger and create (if not govern) change towards sustainability within the company's boundaries and across ecosystem stakeholders.

<sup>1</sup> Intellectual Property Models for Accelerating Sustainability Transitions (IPACST) ([www.jp4sustainability.org](http://www.jp4sustainability.org)) is a four-year international and interdisciplinary research project for understanding the role played by intellectual property (IP) in accelerating sustainability transitions. IPACST is one of 12 transnational research projects by the Belmont Forum and NORFACE joint programme on Transformations to Sustainability (T2S).

Having identified the five dimensions we define an organizational-level, responsible IP strategy as an "IP strategy that deliberately aligns with the organization's sustainability mission; is inclusive (in terms of IP sharing) of sustainability promoting stakeholders; and spans the boundary to enable knowledge co-creation, such as for common purpose technologies. Such IP strategy considers the different impact dimensions (e.g. social, environmental, and economic implications) and societal expectations (e.g. in its value definition) to flexibly evolve over time to best support long-term sustainability transitions."

The paper is structured as follows. Section 2 provides the theoretical background about IP strategy from three viewpoints: IP strategy from the view of IP as a business asset, IP strategy for sustainable development, and IP in times of institutional changes. Section 3 explains the methodology used, including sampling, data collection, triangulation, and analysis. Section 4 presents the results describing and discussing the dimensions derived for responsible IP strategy, and section 5 concludes the paper with implications, limitations, and future research directions.

## 2. Theoretical background

### 2.1. IP strategy and IP as a business asset

IP strategies aim to protect and increase the competitive advantage of businesses (e.g., [24–26]). The traditional incentive theory of IPR argues that IPR systems incentivise innovators and can act as a strategic tool to attract investments for businesses to grow [27], build competitive advantage [28], recoup R&D investments by inventors including smaller firms such as start-ups by internal use [25], and in collaborations with strategic partners [29,30].

Although IPR and IP strategies are usually discussed and analysed in the innovation and technology management contexts, IP strategies go beyond innovation protection. Some IP protection instruments such as patents and utility models focus on protecting technological innovation. While other IP protection instruments such as trademarks, trade secrets and informal intellectual assets such as know-how, data protection strategies and lead time advantages cover business activities and business models beyond innovation efforts more broadly. As part of the intellectual capital of businesses, IP and IPR have become significant assets - in some instances, more valuable than the physical property of businesses [31,32].

More recently, critical economic analysis discusses IPR as strategic tools to manifest and increase the power of businesses and by this de-incentivise companies to put efforts into and compete for productivity growth [33]. When analysing innovation from a broader economic perspective and not from a single firm, especially patents were criticised for holding up innovation given the cumulative nature of innovation where a product or technology combines numerous inventions spread across different owners [34,35].

### 2.2. Role of IP for sustainability

The speed with which countries move towards sustainability depends (at least to some extent) on their technological development, knowledge accumulation, access, and absorption of green and sustainable technologies [36–38]. However, owing to the complex nature of sustainable technologies [13,36,39,40], the body of literature on IP for sustainability presents conflicting views.

One group of researchers suggests IPRs such as patents, trademarks, copyrights, and databases form an organisations' structural capital [41], enhancing an organization's sustainable innovation process [42] and environment-related activities [43]. Researchers in this stream suggest IPR as an instrument to facilitate technology transfer for sustainable development [44]. During the early phases of industry development for clean technologies, major emerging countries like China and India benefited tremendously through inward patent licensing of solar photovoltaic and wind technology [32]. From a social sustainability

perspective, a stream of research shows firm's collaborative IP generations and ownership positively influencing social sustainability [45–47].

However, another set of researchers argues for IPR hindering sustainable development. For instance, from a technology perspective, IP provides a weak incentive to develop green technologies due to a long-time gap between green technological invention and their first commercialisation [36]. Moreover, since many companies hold patent rights on different complex technical components, licensing fees may stake up, increasing transaction cost, thus, blocking the diffusion of green technologies [14,36]. Thus, a protective approach to IP can hinder sustainable development if IPR owners block others from accessing IP protected technologies [48,49]. In environmental and social sustainability contexts, theories around openness and sharing of IP through wider sharing mechanisms like patent commons, pledges and open-source [8,38,50] are discussed as alternatives.

### 2.3. IP in times of institutional changes

Organisations have long used IP to strategically adapt to structural changes in the economy or respective industries [30,51,52] during normal economic development situations but also during crises. The literature on strategic IP management provides examples of companies using IP to push structural changes in their industry [30,51,52], for example, in the agriculture industry [52]. In the ongoing COVID-19 pandemic, IP has played a role in facilitating rapid manufacturing of crisis-critical products (such as ventilators, masks, sanitisers). IP access has been granted (or rather IP rights have not been enforced) to companies from the non-medical sector that have capacity to manufacture crisis-critical products, enabling them to manufacture relevant products and equipment available for urgent and critical needs [4,15].

Business model innovation forms another significant factor for changing industry structures and innovation capabilities. Business models often rely on IP and are centred around the development and licensing of general-purpose technologies, pushing institutional changes in return [51]. In the context of sustainability, however, we find the existing literature lacking a structured understanding of how IP can be used in times of change.

### 2.4. Theory of responsible research & innovation (RRI)

The theory of responsible research and innovations (RRI) has been widely discussed to achieve SDGs. RRI encompasses more inclusive concepts for science and innovation processes, including addressing the needs of less affluent communities, anticipating possible negative effects of innovation, acknowledging tipping points, and limited natural resources. Von Schomberg [22] defines RRI as 'a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and the marketable products (to allow a proper embedding of scientific and technological advances in our society)'.

What does RRI mean in practice? Stilgoe et al. [21] define RRI as 'taking care of the future through collective stewardship of science and innovation in the present' (p 1570) and identify four dimensions for integration in research and innovation, namely, reflexivity, anticipation, inclusiveness/deliberation, and responsiveness. Reflexivity combines three factors for reflection: underlying purpose, motivation and potential impact; anticipation consists of two factors for impact analysis: creating appropriate solutions and creating appropriate policies; inclusiveness refers to listening to the public and the stakeholders; and responsiveness refers to using reflexivity, anticipation, and inclusiveness to set the direction of research and innovation.

While no clear definition of responsible IP strategy exists, two discussions in the literature are relevant: open approaches as an appropriate response for responsible IP and human rights as the responsible IP perspective. For the first one, for instance, Konig et al. [53] study open

IP in synthetic biology and argue against open IP. The authors state a more appropriate question to ask for responsible IP would be how patents and property rights are applied when fostering the development and accessibility of innovations for social benefit. Collaborations with non-profit organisations [54,55] and technology transfer to lower-income countries [56] are some options suggested by Konig et al. [53] as well. Beyer [57], looking at public health, argues for non-exclusive licensing. The author lists characteristics of the sharing agreement, terms and conditions of the licence, including territory, royalties and technology transfer modalities, as some of the main indicators of responsible IP.

Second, research focusing on the relations between human rights and IP appears relevant for understanding what responsible IP could mean. Brown [58] argues for influencing corporate conduct based on human rights and making human rights the basis for legal enforcement. What would be the ambit of those obligations and to what limit should the balancing act be conducted are answered by Brown [58] by discussing options of compulsory conduct, voluntary conduct and use of CSR to meet human rights obligations of IP.

While participatory collaboration processes for more inclusive research, innovation, and technology transfer, require decision-making about sharing mechanisms, joint development and exchange of IP, the empirical and conceptual research on RRI lacks evidence and advice on good practice examples. Stilgoe et al. [21] point towards a need to rethink IPR and patents to move toward RRI; so far, existing research hardly guides adequate management and use of IP. Existing literature lacks evidence-based results to define, characterise and formulate responsible IP strategies for building a sustainable economy. Accordingly, literature lacks consensus on the strategic management and responsible use of IP that best supports sustainability.

## 3. Methodology

The study adopts an exploratory research design, given a limited theoretical and empirical understanding of IP strategies of sustainable companies and dimensions to define responsible IP strategies. Adopting a comparative, in-depth case study approach [59,60], the study develops and analyses five companies with proven social and/or environmental sustainability impact to define and characterise responsible IP strategies for sustainability. Given the limited prior research in this field, comparative case studies allow for an in-depth analysis to explore phenomena and theory building for further investigations. While the external validity of qualitative case studies is generally lower than for large-scale quantitative studies, it is increased by comparing cases in different settings, i.e. regions, countries and sectors [59,60].

The case companies were target selected based on a set of pre-defined criteria. These include the company should have (i) at least one sustainability-oriented innovation (SOI) (technology, product or service) as the core business value proposition, (ii) an IP strategy managing the ownership and the usage of IP assets relevant to the company's SOI and (iii) a proven sustainability impact recognized by any of the united nation bodies or sustainability awards. We adopted a carefully designed multi-step triangulated data-collection methodology [60] to overcome potential biases in the sample (arising due to 'greenwashing' [61,62] by companies), and to ensure internal validity of the findings. For this, we followed a three-step process.

First, we identified, shortlisted, and selected companies recognized by one or more notable international awarding bodies (after undergoing a stringent assessment process) for their significant environmental or social contributions. Next, we collected secondary data about the companies from company's annual reports, sustainability reports, business responsibility reports, Global Reporting Initiatives (GRI) reports, press releases and websites, and other platforms such as media news articles and web articles. Finally, to validate and triangulate the data collected and gain first-hand insights into the company's sustainability performance, we interviewed respective executives and top managers, and

asked for specific facts supporting the performance indicators. For example, if the company states that they have contributed to community development, then we asked them for the number of community development programs conducted, the number of beneficiaries over years, among other validation questions. With this three-step process, including recognitions by external notable awarding bodies, secondary data from websites (prior to talking to companies), and primary interviews with the relevant company executives, we could validate the company's sustainability claims.

The five case studies selected for the development of the responsible IP strategy framework consist of (1) a mission-driven innovative nutrition solution provider,<sup>2</sup> (2) a mission-driven renewable energy incumbent, (3) a social enterprise in the consumer electronic/manufacturing sector, (4) an incumbent providing energy-efficient solutions for industrial and commercial applications and (5) a waste-treatment technology development company. In addition, a sixth company, a large multinational (about 130 plus years old) operating earlier as a traditional profit-oriented business and transitioning to sustainability in the past decade, is included for the external validity of the responsible IP strategy dimensions derived. These case studies constitute a sub-set of the sustainable companies studied as a part of the IPACST project.

For each case study, the study uses primary as well as secondary data sources as described earlier to track the evolution of IP strategy, sustainable business model (SBM) [63], and their sustainability impact (internal as well as external). Each case development involves a four-step process. As a first step, credible secondary data sources are used to map the evolution of the case company's IP strategy, SBM, and sustainability impact in a visual mapping template. Secondly, semi-structured in-depth interviews are conducted with relevant company employees (e.g., Chief Technology Officer (CTO)/IP counsel/IP head for IP strategy interview; Chief Executive Officer (CEO)/sustainability head for sustainability impact and business model interview) to gather primary data. The interviews are conducted using an interactive, visual mapping approach. Each case involves a total of four interviews. Each interview lasts between 1 and 1.5 h (about 4–6.5 h of primary interview per case). Thirdly, visual maps are refined after synthesising and corroborating the data captured from secondary and primary sources and any discrepancies clarified with the companies in the second round of interview. This multi-step approach enables comprehensive data capture and validation from reliable and credible sources ensuring high-quality data and internal validity. Fig. 1 presents an overview of the data collection process along with the visual map templates used. Finally, the synthesised data is presented back to the participants for validation and feedback.

We analysed the data using qualitative content analysis methodology, starting with a directed content analysis approach [64] based on theoretical dimensions derived from the theory of RRI. We then followed the iterative hybrid method that uses literature as well as case description [65] to derive dimensions of responsible IP strategy iteratively. The dimensions from the RRI, namely reflexivity, anticipation, inclusiveness, deliberation, and responsiveness, are used as starting points for coding the cases. Those RRI dimensions that are relevant but limited in scope to capture IP relevance have been redefined while developing codes from the case data. In addition, a new code called co-creation emerged from the data analysis. Fig. 2 depicts the final coding scheme. The data analysis resulted in twelve first-order codes aggregated into 5 second-order codes representing the five dimensions of the proposed responsible IP strategy namely deliberation/intention, sustainability IP alignment, flexibility and timing, inclusiveness, and co-creation. These five dimensions are further grouped into two high-level categories namely the intra-firm and the ecosystem-level categories. The intra-firm

level category represents decisions within the firm boundaries, without involving other players, which include three dimensions namely sustainability alignment, deliberation/intention, and flexibility and timing. In contrast, the ecosystem-level category represents actions involving one or more external entities for implementation and includes two dimensions namely inclusiveness, and co-creation.

To improve the external validity and to demonstrate the trustworthiness and rigour of our findings [66,67], the dimensions were applied and compared before and during the transition period of a sixth case company in its sustainability transition period.

## 4. Results and discussion

Two patterns emerge from the data analysis. First, all the five case studies confirm that a strategic approach to IP forms an integral part of companies' SBM, and companies deliberately design their IP strategies to achieve sustainability goals. Second, the five case companies adopt different IP strategies but exhibit similarities in their considerations in responsibly designing their IP strategies for sustainability. Building on the dimensions of the theory of RRI and the results from the case studies lead to the identification of five dimensions that appear to be integral to responsible IP strategies. These five dimensions are: (i) deliberation/intention, (ii) sustainability IP alignment, (iii) flexibility and timing, (iv) inclusiveness, and (v) co-creation (see Fig. 3). Table 1 summarises these five dimensions of the IP strategies adopted by each of the five case studies. Below we explain each dimension with case examples and supporting interview quotes.

### 4.1. Intra-firm level dimensions

Intra-firm level category includes three dimensions namely deliberation/intention, sustainability alignment, and flexibility/timing dimension.

#### 4.1.1. Deliberation/intention

Responsible IP strategies consider environmental/social implications alongside traditional economic focus by choice and not by chance. This finding confirms prior research stressing transformative changes toward sustainability call for 'deliberate', 'intentional' and 'anticipatory' approaches [68–70]. All five case companies deliberately designed their IP strategies to achieve their sustainability mission by choice and not just comply with regulations or as a part of their corporate social responsibility obligations.

For example, in case #1, the founder started the company as a family business with the mission to prevent and treat malnutrition among vulnerable populations. The company became a private sector pioneer bringing together scientific innovations and industrial excellence with social and environmental responsibility for the treating and preventing malnutrition among vulnerable populations. The company deliberately designed the IP strategy with the intention to meet desired sustainability goals. In developed countries, the company uses patents to block other companies from cheaper mass production. The company licences their IP (incl. patents, trademarks, and manufacturing know-how) to franchisees in the least developed countries (LDCs)/low- and middle-income countries (LMICs), which have a high need for such products. Similarly, case company #4, another mission-driven enterprise providing energy-efficient industrial, commercial and residential technological solutions has reformulated their IP strategy for a specific energy-efficient technology developed by them. The company opened (making the technology freely available for anyone to use) the previously patent-protected technology (while still maintaining ownership through patent renewals) for more significant social responsibility for other manufacturers to build energy-efficient systems. When asked about the intention behind reformulating the IP sharing approach, the response was,

<sup>2</sup> A detailed case study of case#1, a mission-driven innovative nutrition solution provider is available at [https://ip4sustainability.files.wordpress.com/2022/12/nutriset-case-study\\_ip-strategy-for-humanitarian-aid.pdf](https://ip4sustainability.files.wordpress.com/2022/12/nutriset-case-study_ip-strategy-for-humanitarian-aid.pdf).



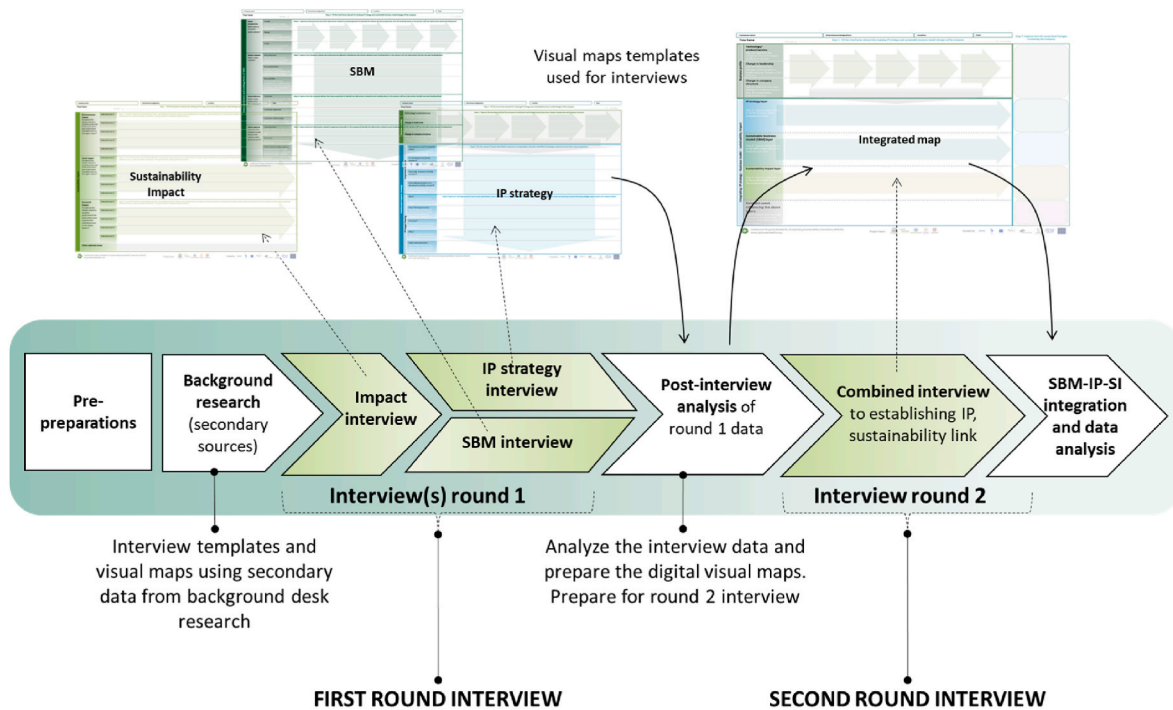


Fig. 1. Multi-step case study data collection process overview (source: own creation).

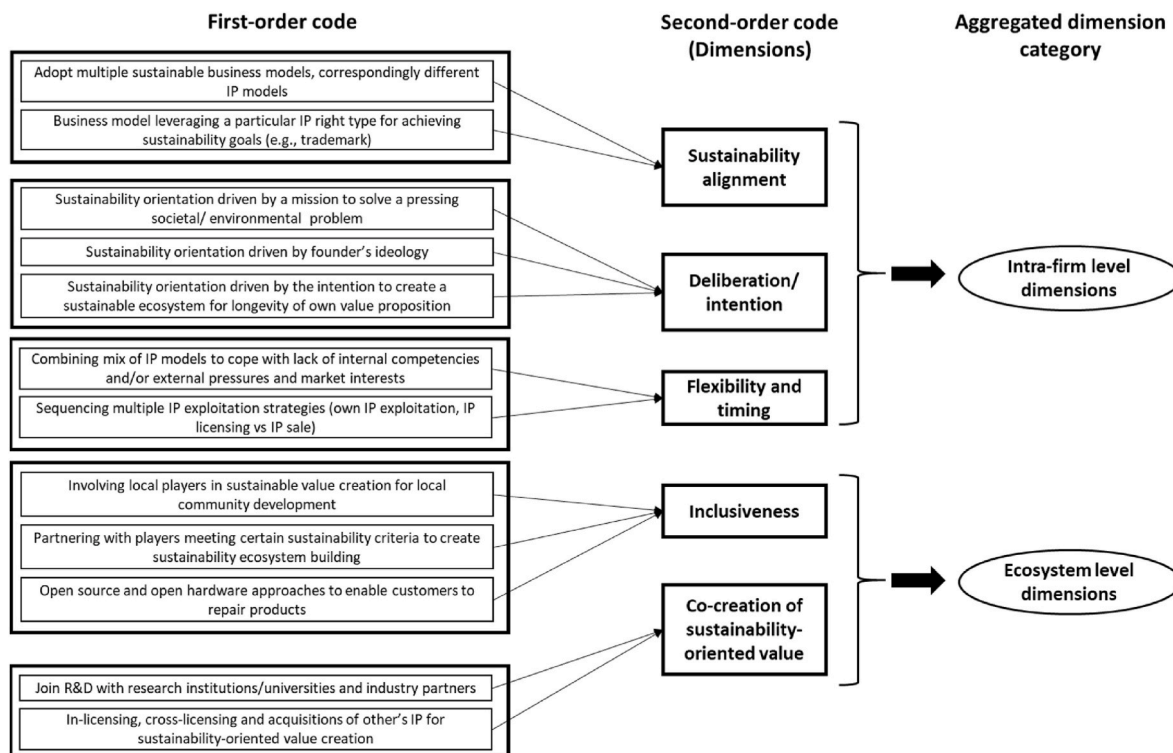


Fig. 2. Coding scheme.

“... If any patent is not relevant, we will just abandon it so that anyone can use it; then, there is no question of sharing it. If we are maintaining a patent and then sharing it, then definitely it is for a particular cause that it is required by the industry for bigger social responsibilities ... any old patents anyway will expire, and people will be able to use them. We don't hold on to that”. [Case #4]

The deliberation dimension forms a critical part of responsible IP strategy because it has a dedicated orientation towards achieving social and environmental impact rather than just economic impact. Regular business firms, i.e., those with non-sustainability-oriented innovations, may use IP deliberately for achieving more of their financial and economic goals and less commonly for social or environmental impact. They may do socially responsible activities as a part of their corporate

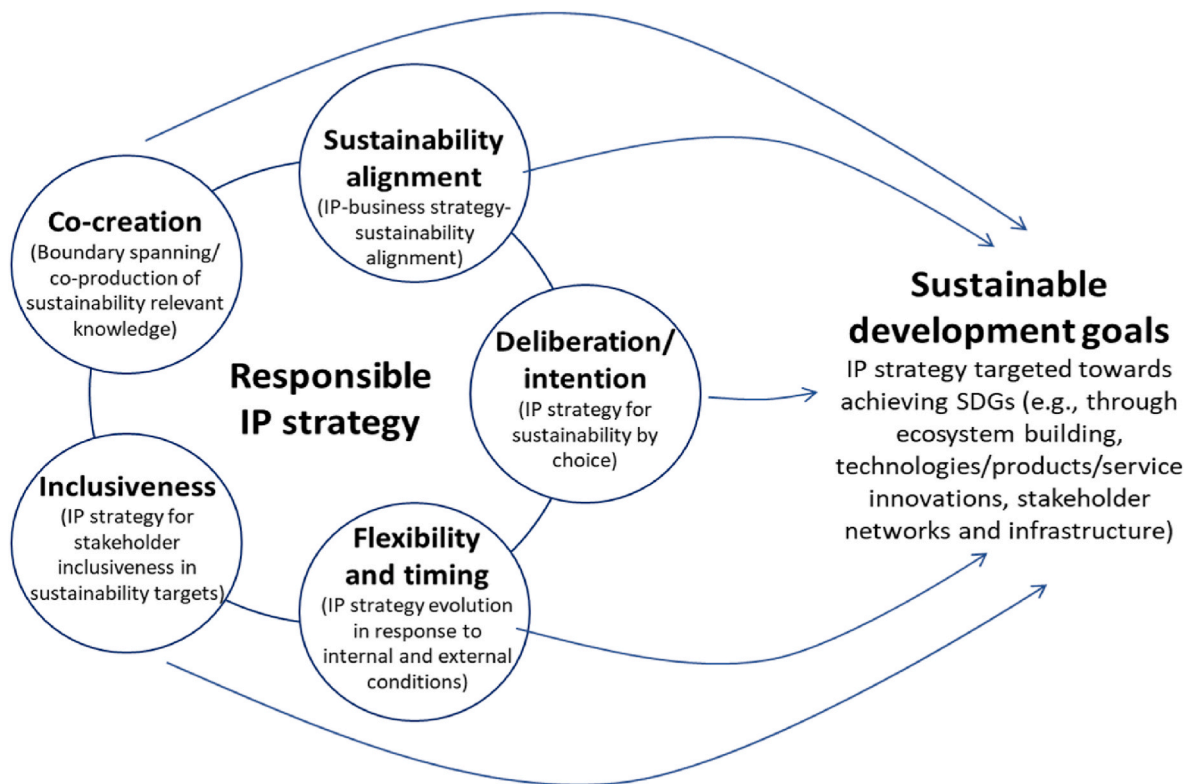


Fig. 3. Five responsible IP strategy dimensions (source: own creation).

social responsibility (CSR). However, to achieve a broader and faster transition towards sustainability, they need to incorporate responsible approaches for their core innovations. Case #1 in our sample could have licensed its patents to other interested multi-nationals to increase its revenue. However, the company decided to restrict access to large multinationals that could compete with and be a hindrance to the development of local players in LMIC. Hence our case examples show that intentional and deliberate IP activities targeted towards achieving sustainability are critical for sustainable development.

#### 4.1.2. Sustainability IP alignment

The case study results indicate that companies operating with multiple SBMs (e.g., inclusive value creation, stewardship role) adopt a mix of IP strategies (e.g., licensing, free sharing) to align the IP strategy to achieve their desired sustainability goals. Clearly, this finding is not just unique to sustainability. Alignment between IP and the company's overall strategy and product architecture is essential to enhance the performance of any business [28,71–73]. Additionally, we find responsible IP strategies are designed in such a way to align not only with the conventional economic business objectives (e.g. profit and financial gains), but also with the company's sustainability mission and SBM. Cases indicate that aligning IP strategies with the sustainability mission of companies creates a positive sustainability impact.

For instance, case company #1 adopted selective IP sharing (with know-how transfer) for a stewardship model (franchise model) and patent usage agreement model (without know-how transfer) to support inclusive value creation business model. Such selective and controlled sharing promoted socio-economic development and public health in least developed and LMICs, thus primarily leveraging the company's social impact. When asked about the importance of IP strategy for sustainability, the Managing Director said,

"Clearly if we had not had an IP strategy at the beginning of 2000, we were not being able to set up local companies in many countries ... We cannot talk about development in this context without IP. It is

closely linked. The sustainable devoted business model we have right now is clearly linked to the IP strategy we took." [Case #1]

One of the well-known examples of sustainability IP alignment discussed in the literature is on the concept of open education. An example being the Massive Open Online Courses (MOOC) system. This system uses open, i.e., creative common licenses intending to offer 'cost- and selection-free education to students', but simultaneously allowing for the generation of commercial revenues (through complementary purchases such as for obtaining certificates and textbooks), depending on the level of openness of the selected open license. Such a wide reach of educational knowledge wouldn't have been possible only with the conventional education system where the educational contents are not shared freely.

#### 4.1.3. Flexibility and timing

All five cases studied exhibit flexibility in their IP strategy by adopting a combination of IP models ranging from protective, selective sharing to free sharing of IP [18,47,56]. This finding aligns with the theory of responsible innovation (RRI), and we find responsible IP strategies embed the capacity to adapt to the changing internal and external environment and implement a mix of open as well as closed IP models over time [42]. In general, strategic flexibility has been defined as the 'ability of the organisation to adapt to substantial, uncertain and fast-occurring environmental changes that have a meaningful and positive impact on the organisation's performance' [74,75] especially in fast-paced industries [76].

For instance, case #1 implemented a patent usage agreement model as a response to humanitarian stakeholders' opinions about the monopolistic nature of patents. Case #4, on the other hand, shows flexibility in IP sharing, while keeping the core technology's IP protected, the company shares the IP for developing complementary technology and building ecosystem for sustainability. Further, some of the protected IP gets shared for free. The company has also opened (making freely available for anyone to use) the previously patent-protected

**Table 1**  
Five responsible IP strategy dimensions for the five cases studies.

Case reference	IP strategy	Responsible IP strategy dimensions				
		Intra-firm level dimensions			Ecosystem level dimensions	
		Deliberation/ intention	Sustainability alignment	Flexibility	Inclusiveness	Co-creation
<p>Case #1</p> <p>A mission-driven innovative nutrition company offering process and product-oriented innovations</p>	<p>Protective and semi-open IP strategy combining different IP models: selective licensing of IP to local entrepreneurs (denies licenses to incumbents); patent usage agreement vs industrial know-how transfer as a part of the unique network model.</p>	<p>Company’s mandate is to provide nutritional autonomy for all. The IP strategy is designed as a means to achieve the targeted sustainable development goals (SDGs 1 &amp; 2).</p>	<p>Adopts two SBMs: (i) inclusive value creation through a unique network/ franchise model and (ii) a stewardship role, supported respectively by the selective IP (including industrial know-how) sharing and patent (only) usage agreement model.</p>	<p>Mix of different IP models in response to internal and external conditions, e.g., patent usage agreement model as a response to humanitarian stakeholder’s opinions.</p>	<p>IP strategy is designed to offer freedom to operate and bring together the local farmers, local manufacturers, humanitarian actors, government and local beneficiaries (children and mothers) to build a local, sustainable ecosystem.</p>	<p>Partly through joint R&amp;D and IP generation with research institutes (majorly in-house R&amp;D), IP sharing for co-creation/co-production.</p>
<p>Case #2</p> <p>A mission-driven renewable energy incumbent offering service-oriented innovations</p>	<p>Protective and semi-open IP strategy including mix of IP models: Trademark dominated strategy with selective licensing and co-branding only with sustainability-focused actors; patent focused strategy less dominant.</p>	<p>Driven by the founder’s ideology of green and sustainability with a commitment to change the way electricity is made and used (SDG 7) to replace fossil fuels with green alternatives.</p>	<p>Adopts the SBM - substitute with renewables and natural processes. Trademark focused IP strategy supports signalling to customers the existence of green energy alternatives.</p>	<p>Mix of IP models in response to internal and external conditions: e.g., patenting for own exploitation, licensing attempts if own exploitation fails, if not then let the patent lapse.</p>	<p>Business strategy with IP as an integral part is designed to collaborate with only those companies that meet sustainability criteria set by the company in the supply chain, inclusive of customers’ feedback.</p>	<p>Partly through acquisitions and university collaborations (majorly in-house IP generation).</p>
<p>Case #3</p> <p>A mission-driven born sustainable consumer electronics company</p>	<p>Open IP strategy: process and product know-how mostly not patented but shared openly with interested parties via., free reports, open-source software and open hardware. Selected patenting for securing freedom to operate. Strong trademark focus to increase brand awareness for sustainable products.</p>	<p>IP strategy designed to target change towards sustainability not only for their own product but for the consumer electronics/ manufacturing sector widely through supply chain focus, improving work conditions, for customers improving longevity of product and enabling repairability (SDGs 9, 8, &amp; 12).</p>	<p>Adopts two SBMs: a stewardship role and closing resource loops both supported by IP sharing and co-creation strategically. Environmental and Social impact is equally important as financial impact.</p>	<p>Mix of IP models in response to internal and external conditions: e.g., durable and high-performance product components are based on patented IP - the business chose longevity and product usability as the compromise on quality to go for pure open hardware option was too severe. Also, moved from pure open-source software for increasing usability, market acceptance and growth.</p>	<p>Employs a strategic sharing approach of the IP to reach out to and collaborate with stakeholders, including competitors and businesses, other NGOs and governmental organisations along the supply chain, improve the resource extraction and manufacturing for the whole sector. Open-source and open-hardware approach for enabling customers to repair products hence increase longevity.</p>	<p>Joint development with research institutes and stakeholders (manufacturers) and shares IP with other actors.</p>
<p>Case #4</p> <p>A sustainability-oriented large enterprise providing affordable, environment-friendly and energy-efficient industrial, commercial and residential technological solutions</p>	<p>Protective, semi-open and fully open IP strategy. Selective because the company does not share the IP on the core technology, but for complementary technologies, it enters into cross-licensing, IP consortium, product partnerships, technological &amp; industrial know-how transfers. Selected IP is also shared freely.</p>	<p>IP strategy of the company enables it to build an industrial ecosystem to solve environmental issues like CO<sub>2</sub> emission, energy, and food and water consumption during manufacturing and commercial activities (SDGs 7, 8, 9, 12 &amp; 17).</p>	<p>Adopts two SBMs, i.e. maximise efficiency, and adopt a stewardship role. Both the SBMs get supported by its’ mixed IP strategy, where the company keeps the core technology protected while sharing the IP with (also in some cases, making the IP freely available) multiple stakeholders to develop an ecosystem for sustainable development.</p>	<p>Mix of different IP models in response to internal and external conditions: e.g., being flexible in IP sharing while keeping the core technology’s IP protected, the company shares IP for complementary technology development and ecosystem building for sustainability. Also, shares some of its protected IP for free.</p>	<p>IP strategy is designed to enable collaboration with the customers, supply-chain partners or vendors, competitors, and also with companies in other industries. Shares the industrial and technical know-how with small and new local players to develop an ecosystem for sustainable electricity generation for the local community from food waste.</p>	<p>Collaborative as well as internal R&amp;D acquires IP from outside firms and also licences permission to use other’s IP; also shares own IP with others.</p>
<p>Case #5</p> <p>A small mission-driven tech company providing innovative solutions for urban circularity</p>	<p>Protective and semi-open IP strategy: Core technology protected (prefers utility models and trade secrets over patents) and used as a</p>	<p>IP strategy enables the company to offer high-tech urban solutions that reduce water consumption and provide efficient</p>	<p>The company adopts two SBMs to create a positive sustainability impact: Creating value from waste and developing scale-up</p>	<p>IP strategy is flexible to accommodate growing market interest: while the core technology is being protected, the</p>	<p>IP strategy enables to build a reputation of “attractive collaborator”, which helps the company to access new markets</p>	<p>Mostly in-house R&amp;D, recently increasing in focus on collaborative, joint R&amp;D with universities, research institutes, industry</p>

(continued on next page)

Table 1 (continued)

Case reference	IP strategy	Responsible IP strategy dimensions				
		Intra-firm level dimensions			Ecosystem level dimensions	
		Deliberation/ intention	Sustainability alignment	Flexibility	Inclusiveness	Co-creation
	platform to collaborate with other tech companies. Currently considering expanding their knowledge-sharing through licensing.	ways for water recycling and reuse, promoting ways for retrieving monetary value from municipal waste. (SDGs 7,9,11,12,& 17).	solutions for sustainability supported by the protective IP and licensing approaches.	company is developing new apps and products with partners in Europe and Asia interested in integration and adoption of the technology.	and bring together local industrial partners, municipalities, start-ups, real estate companies, innovators and researchers to work together towards sustainability targets.	partners. IP sharing through cross-licensing

technology (while still maintaining ownership through patent renewals) for more significant social responsibility for other manufacturers to build energy-efficient systems.

“We had developed a special energy-efficient technology ... for home applications. Previously, it was our proprietary technology, but over the period, it was observed that it is a very efficient system that can help many households, and other manufacturers can also develop communications with these kinds of protocols. Subsequently, we opened this technology for the benefit of society ... The criteria to decide whether to open a patent or not is not the relevancy of the patent ....” [Case #4]

The timing of their IP asset types forms another aspect of flexibility that became evident from case companies. For example, companies find certain IP assets (e.g. trademarks and know-how) more valuable in the early and matured stage of their business and other IP assets (e.g. patents) more valuable during the growth phase. Such timing of IP assets gets evidenced in regular business as well (not only sustainability-oriented) and sometimes form a natural part of an IP strategy evolution [42].

4.2. Ecosystem level dimensions

Ecosystem level category includes two dimensions namely inclusiveness, and co-creation.

4.2.1. Inclusiveness

All the five case studies exhibit inclusiveness as part of how they use IP for sustainability. The finding again concurs with prior literature. Stakeholder inclusiveness has been shown to promote sustainability in different sectors [77,78]. As a part of their responsible IP strategy, the case companies proactively embed stakeholder ecosystem building as a prime concern while developing sustainability practices both within their organisation and among stakeholders within the ecosystem (e.g., value chain or supply chain partners).

For example, case company #2 engages in co-branding, collaboration and partnerships, thus being inclusive and boundary spanning, but strategically only with actors satisfying specific sustainability criteria and denying IP usage rights to unsustainable actors. The company uses the company trademark as an assessment tool for selecting partners, i.e. as a contractual entry barrier for their ecosystem admitting only those companies that meet sustainability criteria set by the case company for supply chain. If any partner company does not meet the sustainability criteria at any time, the company reserves the right to terminate the trademark licensing agreement.

“... standard [trademark] licence agreement will give us the right to terminate if they [partners] are engaged in activity that is derogatory, unlawful ... ” [Case #2]

With the selective IP approach model, the company has built a renewable energy ecosystem with hundreds of partners. In addition to supply chain partners, the company has also used its trademarks as a valuable signalling tool to create awareness about sustainable alternatives and incorporated feedback from customers in the business operations.

“ ... talking about trademarks, company names, and domain names as protective initially in the sense of gathering an exclusivity ... the use of a mark like that does in fact raise awareness of green products, raise awareness of green services, alerts people to the fact that they don’t have to buy non-green brand ... ” [Case #2]

There are many examples in different industries of how businesses use an inclusiveness approach for functionality of technology. They share IP assets with stakeholders such as supply chain members and competitors and integrate user perspectives and different types of users, e.g. on data transmission technologies in the electronic sector, and to achieve safety standards such as airbags in automotive that are suitable for people of different sizes and weight. The cases reveal that this approach appears also suitable to build ecosystems for environmental and social sustainability solutions.

4.2.2. Co-creation

Responsible IP strategies are boundary spanning, accessing relevant IP from external sources and sharing own IP with others in need to promote sustainability benefits not only within the organisation but also to the external market, stakeholders and society at large. All five cases exhibit co-creation through boundary-spanning behaviours in one form or another. Such boundary-spanning activities promote the co-production of knowledge and co-designing needed for sustainability transformative changes [69,70].

Case #3, for instance, mentions open sharing of IP as a precondition for building strong partnerships with stakeholders. The value of sharing, however, is outbound as well as inbound. The IP developments were all collaboratively created with others:

“... so basically almost everything and everything in here, everything that we build in the impact innovation is developed with others. I don’t think we have something that we really came up with only ourselves. Which would probably also be impossible. because you always have to talk to other experts” [Case #3]

When asked if the company regrets sharing their IP openly instead of restricted use, the interviewee responded:

“Well, I don’t think we have a choice here because we basically have to build a partnership. And when you build a partnership, when there’s not, well, you know, you have to actually convince people to want to join this partnership.” [Case #3]

Case company #4, as their IP strategy, protects the core energy-



efficient technology while entering into diverse collaborations with supply-chain partners, competitors, and companies in unrelated industries to develop complementary technologies and sub-systems around the core technology.

“... we and our close competitors for that field have an industry consortium ... where 5–6 companies come together and we cross-license our IP so that each one of us can use that IP and we can develop a next generation technology by holding hands with each other ...” [Case #3]

Similarly, case company #5, as part of the IP strategy, uses IP to protect the core technology and use IP as a platform for joint R&D of new apps and products with other industries, and cross-licensing to stakeholders interested in integrating and adopting the technology. IP gets mainly developed through in-house generation, but recently the company shows increased focus on open innovation. Several newly developed technologies have been developed jointly with partners inside and outside of the industry through product partnerships and cross-licensing agreements.

“At the beginning, I wanted to be sure that our part, our core technology, is good and safe, and protected and then we can go out to find partners and ... good cooperation where our technology is acknowledged as an important part of something we are going to develop together”. [Case #5]

Research on innovation, especially on open innovation, has provided insights into the benefits of co-creation to develop and improve more robust solutions that serve societal needs and at the same time increase the speed of diffusion [22,23,79].

### 4.3. Validation of the responsible IP strategy dimensions: a case of a company transitioning to sustainability

To validate the dimensions of responsible IP strategy resulting from the case studies, we applied the dimensions to a sixth case company transitioning to sustainability. In other words, the company has shifted from being a traditional (bottom line focused) business to a

sustainability-oriented one. The company is a large B2B multinational (over 130 years old) started in the energy sector but later expanded into other related industries such as power, electronics, and cold chain. The company incorporated sustainability as a part of its core business objective in 2019. We specifically selected a company in transition for validation as in-transition companies form a good example to study the dimensions before and after change towards sustainability orientation.

The company underwent two major changes. First, the company restructured the business units in 2015, with sustainability not as an explicitly stated business objective, but as implicit transition evidenced through their shifting focus towards sustainable solutions (e.g. energy efficiency, CO<sub>2</sub> emission focus). The company made sustainability a core part of the business objective in 2019. Prior to 2015, the company shifted from cost reduction to energy efficiency at the overall system level in 2013. Hence, we consider the time window from 2013 onwards as the company’s sustainability transition period and compare the dimensions before and during the transition period as depicted in Fig. 4.

Along the sustainability IP alignment dimension, the company has clearly reoriented the business model from a predominantly product development and integration-based business model to an ecosystem actor-focused business model around early 2010s and recently to outcome-based and service-focused business model since 2019. While the company has always aligned the IP strategy to its business strategy (e.g., IP protection to support own product development and integration), strategic thinking about IP to support sustainability is evidenced only during the transition period from 2015, and more strongly since 2019. Accordingly, we observe a shift in the IP focus from a legal asset to protect inventions for own usage. We also witness the company using IP as a business tool for enabling collaboration with other industry players, start-up hubs, new technology entities, and even with customers to support the company’s sustainability business objectives.

Along the deliberation dimension, the company’s sustainability impact contribution in terms of energy efficiency and reduced CO<sub>2</sub> emission started once the company intentionally made sustainability its core business objective and used IP to engage with system-level actors to achieve energy efficiency. Even before the transition period, the company engaged in several CSR activities such as providing monetary and

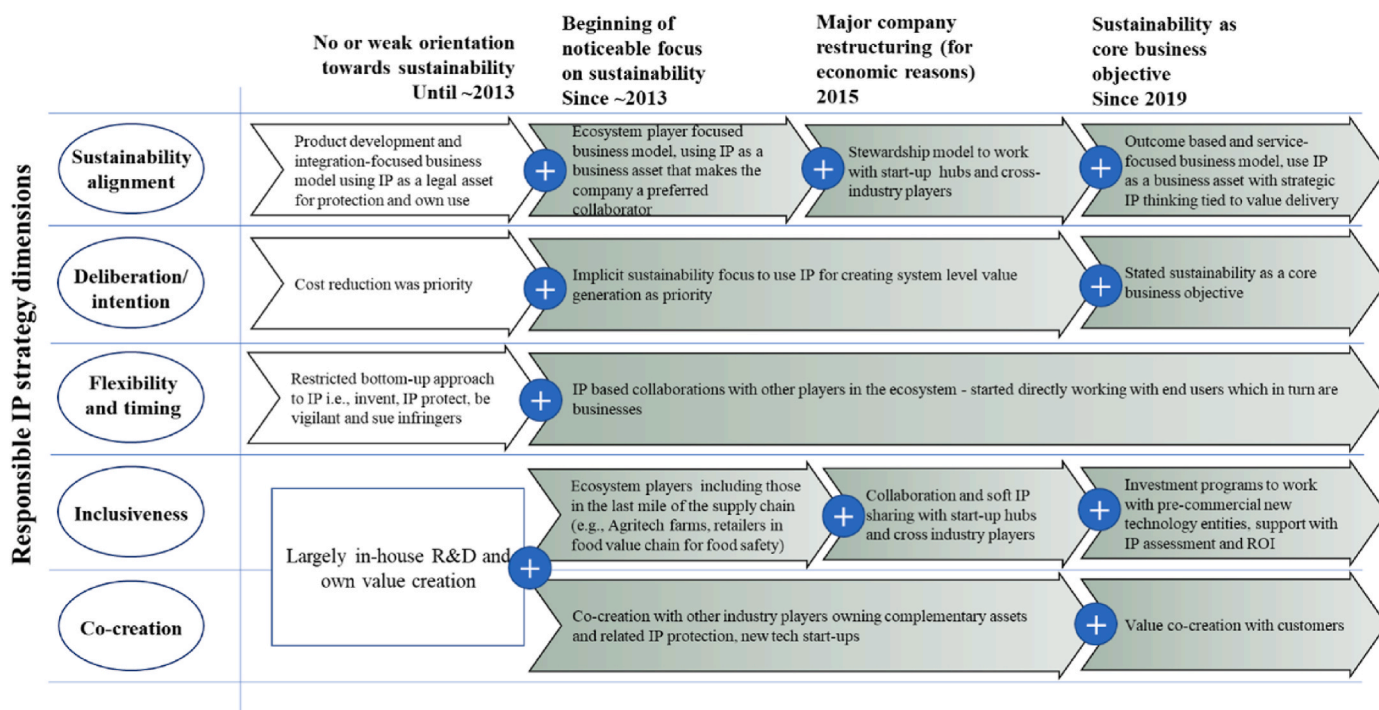


Fig. 4. Responsible IP strategy dimensions of a company transitioning to sustainability (source: own creation).

in-kind support worldwide in education, public health, training, skill development and several other philanthropic activities. However, the role of IP for sustainability was limited. The negative impact on the environment from core business started reducing once the company made deliberate actions to steer the core business and IP activities towards sustainability impacts.

For the flexibility and timing dimensions, the case shows a mix of IP models, namely, protecting IP for own use and IP sharing for mostly value creation for the company through collaboration. However, this flexibility started a few years before the transition period in response to the need to accelerate its innovation process (around 2012). The company, though does not actively engage in out-licensing, has reported a willingness to monetize the IP in future through sharing (licensing). This probably indicates the need for further consideration of the dimension by the company for accelerating the transition.

The inclusiveness dimension gets clearly evident from the above descriptions as well as the company's engagement more widely with start-up hubs, new technology entities and end customers to involve them in the company's sustainability journey. Specifically, for the cold storage business in the food industry, the company engages with players ranging from farms to retail, in order to ensure food quality and safety.

Along the co-creation dimension, the company has moved away from only relying on their own IP creation. The deliberate focus on sustainability since 2019 also pushed the company to co-create not only with industry partners but also with end users and customers, indicating also the interconnectedness among the dimensions.

The case also demonstrated that sustainability journeys are not being free of obstacles. To quote one example, the company started engaging in collaborative innovations in the beginning without careful attention to IP terms in the collaboration agreement, particularly the ownership of the foreground IP (IP generated from the collaboration). The collaborator, an original equipment manufacturer (OEM), went and filed for patent protection independently for the foreground IP. Consequently, the case company lost the opportunity to license the IP to other OEMs in the market. With the lesson learned from the first collaboration, in subsequent collaborations, the company has been carefully drafting the IP terms in the legal agreement to protect any possibilities to offer solutions to multiple market players. Understanding the conflicts and challenges that arise in implementing the dimensions deserves separate investigation and can be worthy of future research. Here, we present some insights about a possible challenge in implementing the dimensions and moving towards building a responsible IP strategy.

The above case example demonstrate that the dimensions identified for the responsible IP strategy have certain characteristics that non-sustainability performing entities may lack, as evidenced from the pre-transition status for the company.

#### 4.4. Defining responsible IP strategy (R-IPS)

Following the results and identification of the five dimensions based on the case study data, we propose to define the notion of 'responsible IP strategy' (R-IPS) as follows:

"A responsible IP strategy is an IP strategy that deliberately aligns with the organization's sustainability mission; is inclusive (in terms of IP sharing) of sustainability promoting stakeholders; and spans the boundary to enable knowledge co-creation, such as for common purpose technologies. Such IP strategy considers the different impact dimensions (e.g. social, environmental, and economic implications) and societal expectations (e.g. in its value definition) to flexibly evolve over time to best support long-term sustainability transitions."

We also find inter-dependence among the five dimensions of the responsible IP strategy. For example, a firm with a sustainability mission also shows the tendency to strategize their IP sharing and usage intentionally to promote sustainable development. To give a specific

example, case #1 embedded inclusiveness (i.e., IP strategy targeted towards local players) and flexibility (different IP models to cater to different IP users to increase sustainability impact) in the IP strategy, primarily because of its sustainability orientation (sustainability alignment) of providing nutrition for all. Evidently, intra-firm sustainability orientation forms a pre-condition for firms to use IP responsibly to create sustainability within the wider innovation ecosystem.

## 5. Conclusions and contributions

This research contributes to the broader debate on the role of IP and its strategic management for sustainability. The paper provides evidence-based findings about IP strategies that sustainability-focused companies adopt to balance their societal responsibility, mission and business goals without compromising (too much) on their environmental and/or social impact at their internal operational level, external market level, and wider sectoral level. Based on these findings, we contribute by conceptualising and defining 'responsible IP strategies'.

Our research identifies five dimensions that are integral to responsible IP strategies, namely deliberation/intention, sustainability IP alignment, flexibility and timing, inclusiveness, and co-creation to take into account for a company desiring to formulate IP strategy for achieving their company's mission without compromising on environmental and/or societal impact.

We also find that while RRI provides a reasonable basis for investigating responsible IP strategies, the dimensions of RRI, namely reflexivity, anticipation, inclusiveness, and responsiveness have limitations in fully explaining what constitutes a responsible IP strategy. At the firm level, when formulating a responsible IP strategy for sustainability, companies incorporate the reflexivity and responsiveness dimensions of RRI through the two dimensions, namely deliberation/intention and flexibility and timing, respectively. For the anticipation dimension, the RRI suggests creating appropriate solutions and policies. Adapting the same for the firm-level IP strategy, we find that companies create appropriate IP and sharing practices by aligning them with their sustainable business objectives, as captured through the sustainability IP alignment dimension. For the inclusive dimensions, however, responsible IP strategy goes beyond what RRI suggests as inclusive. We find companies adopting inclusiveness in IP strategy not only listen to the public and the stakeholders as the RRI suggests but use IP assets as a tool as well to steer the stakeholders and public towards sustainable practices and behaviour. Co-creation emerges as a dimension of the responsible IP strategy but does not get adequately captured as a part of RRI.

The concept of a responsible IP strategy provides a framework for managerial decision making in IP strategy related matters linked to sustainability. The proposed dimensions, if turned into a scoring tool, i.e. scored on a scale from high to low, can also be used as an assessment (diagnostics) tool for companies to assess the level of responsibility of their IP strategy and to indicate areas of improvement in formulating an even better responsible IP strategy to maximise the company's contribution towards sustainable development goals.<sup>3</sup> In terms of policy implications, the five dimensions indicate that responsible IP strategies require support beyond what the current IPR systems offer and emphasise the need for strategic focus on policy initiatives targeted at the use and particularly sharing of IP for sustainability.

The paper is not free of limitations and opens multiple avenues for further research. Though we have carefully selected the case companies, our current investigation is based on five case studies from varied industries and future research could focus on validating this framework using more case studies or quantitative data from a homogeneous industry setting. Furthermore, the external validity is limited in the sense

<sup>3</sup> An example of a toolkit developed by the IPACST project team for IP asset assessment for increasing sustainability impact is available at <https://ip4sustainability.org/knowledge-briefs/>.

we validate the framework using only one case company in its transition period. Future research applying the framework to multiple case studies can further improve the trustworthiness and rigor of the framework. We do not include contextual differences in responsible IP strategies, and that forms another part of the limitation. Future investigations for contextual differences such as variation across industries, technology types, firm sizes, and sustainability orientations (social vs environmental) will add to the insights in the paper. Further, for enhanced managerial implications, the contributions from the paper can be used as a basis for developing a managerial tool for formulating responsible IP strategies.

### CRedit authorship contribution statement

**Pratheeba Vimalnath:** Conceptualization, Investigation, Formal analysis, Writing – original draft, Writing – review & editing. **Frank Tietze:** Conceptualization, Writing – original draft, Writing – review & editing. **Elisabeth Eppinger:** Investigation, Writing – original draft, Writing – review & editing. **Akriti Jain:** Investigation, Writing – original draft, Writing – review & editing. **Anjula Gurtoo:** Writing – original draft, Writing – review & editing. **Maximilian Elsen:** Writing – review & editing.

### Declaration of interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests

### Data availability

The data in anonymized form is available upon request.

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