Sustainability as the Missing Link to Uncover the Double Edge of NFT Technology Legitimacy

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Sustainability as the Missing Link to Uncover the Double Edge of NFT Technology Legitimacy

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ABSTRACT
Although academic and practical interest in non-fungible tokens (NFTs) has continuously increased over the last few years, there is still a need to better understand their social acceptability. The aim of the study was to explore the double edge of NFT legitimacy for NFTs by unveiling the role of sustainability and by adopting technology legitimacy and the field of sustainability transition studies as a theoretical lens. Specifically, this research investigates the role of sustainability in securing and maintaining technology legitimacy within NFT projects. We interviewed 12 experts through exploratory qualitative research. The findings highlight three main ways in which sustainability participates in the legitimation of NFT projects. While sustainability can be inherent in the NFT project itself, this legitimation can also be derived from the perceived sustainability of the NFT technology or be part of innovative business models. Theoretical contributions and managerial implications are then discussed.

KEYWORDS: NFT, Institutionalization, Sustainability, Legitimation, Digital Innovation

JEL CODES: O33, O35, O50
NFTs (non-fungible tokens) were designated “word of the year for 2021” by Collins Dictionary (Flood, 2021), where they were defined as unique digital certificates registered in a blockchain and used to record ownership of assets (e.g., artworks or collectibles) (Collins Dictionary, 2022). NFT sales jumped from a daily trading volume of US$60,000 to $10 million in March 2021 (Bao, Roubaud, 2021). In the first four months of 2021, the NFT volume reached US$2 billion, ten times more than the entire NFT trading volume of 2020 (Nadini et al., 2021). The year 2021 also witnessed the most expensive NFT sales worldwide, including Beeple’s everyday digital artwork (which sold for $69.3 million by Christie’s) and the CryptoPunks profile picture (PFP) collection created by Larva Labs (Statista, 2021).

Since then, NFTs have been viewed as alternative investment assets (Schaar, Kampakis, 2022). NFTs offer valuable artistic and financial opportunities for creative industry entrepreneurs (Chalmers et al., 2022). They also challenge conventional marketing and brand management understandings of ownership, uniqueness, value, engagement, and community (Hofstetter et al., 2022; Colicev, 2022), and have transformed real estate (Ante, 2022) and sports markets (Baker et al., 2022) as well. Generally, NFTs are perceived as having the potential to disrupt markets, culture, and society (Bao, Roubaud, 2022; Chandra, 2022), raising as many opportunities as risks among various stakeholders, such as content creators, technical and business intermediaries, consumers, and investors (Wilson et al., 2022), and empowering business model innovation in the process (Li, Chen, 2023).

The year 2022 saw the NFT market facing severe drops in the volumes of tokens exchanged, in the total volume of resale profits, and in the average price of NFTs. Since May 2022, NFT trading has no longer been profitable for most players1. Additionally, media coverage started to qualify NFTs as a huge speculative bubble, an environmental bombshell, and even the largest Ponzi scheme in history (Besancia, 2021), which has challenged the legitimacy of this innovation (Dehler-Holland et al., 2022).

Generally, NFTs have been criticized mainly because of their ecological impact (i.e., the massive amount of electricity used to mint them) (Calma, 2021). The Merge of Ethereum (the leading blockchain used to mint NFTs) entailed the transition from proof-of-work (i.e., one single NFT transaction emitting almost 784 kilograms of carbon dioxide, equivalent to more than 124,000 hours of watching YouTube) to proof-of-stake (i.e., the same transaction emits almost 0.02 kilograms of carbon dioxide, equivalent to about three hours of watching YouTube), which helped to drastically reduce the energy

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1. NonFungible.com, 2022
use of NFTs (Garnett, 2022). From the societal side, NFTs are still viewed as a market full of scams and thieves, as well as wash trading and money laundering activities (Chainalysis, 2022). Such technology has amplified the digital divide among genders, generations, and countries worldwide (Foster, 2022). Nevertheless, NFTs are increasingly being used to create social value, specifically by providing creators with a platform to share their ideas and express themselves while monetizing their work and fostering community engagement and a sense of ownership and belonging (Vick, 2022). There are thus many potential ways to demonstrate the social impact of NFTs (Cryptoaltruism, 2022), and such technology has the potential to bring substantial benefits to businesses and society while embracing more sustainable practices and alternatives (Truby et al., 2022).

Sustainability issues are major challenges for society (Markard, 2020). Sustainability transitions (i.e., long-term fundamental transformations in technologies and industries to attain sustainable modes of production and consumption) attempt to address these challenges, notably through technology deployment and change (Markard et al., 2012). Nevertheless, successful sustainability transitions require persistent societal support (Geels et al., 2017). As such, maintaining technology legitimacy within such transitions is crucial for their success across their life cycles (Dehler-Holland et al., 2022). Technology legitimacy is defined as “a commonly perceived alignment (or misalignment) of a focal technology with institutional structures in its context” (Markard et al., 2016, p. 333). Such legitimacy focuses mainly on the technology itself (Markard et al., 2016) and is reached once this technology is perceived as appropriate and desirable by key stakeholders, who include consumers, manufacturers, policymakers, scientists, and industry associations (Weiss, Nemeczek, 2021).

Creating and maintaining legitimacy is key for novel and radical technologies suffering from the liability of newness (Geels, Verhees, 2011). However, technology legitimacy can be contested when it is aligned with some institutions and not with others. For instance, nuclear energy (Markard et al., 2020), biogas technology (Markard et al., 2016), and wind power (Dehler-Holland et al., 2022) were all delegitimated after having gained their legitimacy as solutions with low CO₂ emissions to fight against global warming. Furthermore, previous research has often adopted a normative view of the necessity of established sectors to fundamentally change to address grand sustainability challenges (Geels et al., 2017), thereby neglecting radical technologies and their sustainability potentials. Finally, while radical technologies create paradoxical tensions between their potential costs and benefits, little is known about the measure of radicalness to keep in nascent technology, in contrast
to the need to conform to established social norms and values (Ferreira et al., 2023).

The present research aims to explore the double edge of legitimacy for NFTs by unveiling the role of sustainability in this process and by adopting technology legitimacy as a theoretical lens. Therefore, our research question is articulated as follows: what is the role of sustainability in gaining and maintaining technology legitimacy within NFT projects?

Our research contributes to innovation studies addressing the role of technology legitimacy in technical innovation journeys (Geels, 2018; Geels, Verhees, 2011). We also contribute to the field of sustainability transition studies by considering a novel digital distributive technology, uncovering its institutional structures (Markard et al., 2016), and unveiling its potential to be associated with sustainability goals (Markard, 2020).

This article comprises several parts. It first presents the literature review and then the empirical setting. The following section is dedicated to theoretical contributions and managerial implications, and a conclusion is offered at the end.

**Theoretical Background**

**Technology Legitimacy and Sustainability**

The creation of legitimacy for novel and radical technologies is vital (Bergek et al., 2008). This legitimacy allows them to secure resources and regulatory support (Zimmerman, Zeitz, 2002). As such, legitimacy is an important function within technological innovation systems (TIS), as it impacts the expansion and diffusion of novel technologies. Systems that fail to create and maintain legitimacy for their focal technology would jeopardize the establishment of new markets, thereby threatening the entire system (Rohe, Chlebna, 2021).

In this context, Suchman (1995) defined legitimacy as “a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions” (p. 574). Legitimacy is not given and cannot emerge by itself; rather, it is the result of a collective social process contingent upon its context (Johnson et al., 2006). A technology that is understood and aligned with established and socially accepted practices and that has earned regulatory endorsement gains a high degree of legitimacy, which is critical for its success. Likewise, technology expansion is hindered in the case of institutional misalignment.
(Markard et al., 2016). In the TIS literature, technology legitimacy is viewed as the outcome of collective action. At the societal level, such legitimacy can also be impacted by shifting challenges and issues (Bergek et al., 2008).

Technology legitimacy is the overall perception of whether a technology is aligned to its context and is ultimately a “matter of social acceptance” (Bergek et al., 2008, p. 416). Such technology is characterized by the following four dimensions: cognitive (i.e., what the purpose of the technology is and how it is understood); normative (i.e., what the informal design norms and rules are and how the technology is aligned to them); regulatory (i.e., what the socio-technical materialization of the technology is and how it is aligned to pro forma standards and regulations); and pragmatic (i.e., what the stakeholders’ self-interest is in relation to the technology and how they may participate in its deployment) (Dehler-Holland et al., 2022; Markard et al., 2016).

The legitimation of radical technology follows four stages: innovation (i.e., the creation of the technology); local validation (i.e., local actors perceive the novel technology as compatible with existing cultural frameworks of beliefs); diffusion (i.e., the novel technology is applied to new contexts); and general validation (i.e., the technology becomes part of society’s shared culture) (Johnson et al., 2006). Such legitimation will depend on its perceived benefits compared to alternative technologies, as well as its capacity to achieve cognitive, normative, regulatory, and pragmatic legitimacy in the eyes of relevant stakeholders (Bergek, 2019).

Stakeholders and audiences may hold different views on the legitimacy of a technology (Markard et al., 2016). As radical technologies can no longer evolve in isolation because of their embeddedness in their institutional environment, these technologies need to conform to existing institutions and/or to create and modify institutional arrangements to improve their acceptance (Jain, Ahlstrom, 2021).

Novel technologies often face a legitimacy deficit in their emerging stage, suffering from the liability of newness, which can be perceived as “strange, weird, or unfamiliar” (Geels, Verhees, 2011). The formation and change of the technology and the institutional structures, as well as their relationships, contribute to changes in technology legitimacy (Markard et al., 2016). Such institutional dynamics are salient in technology development, which are often scrutinized by audiences because of their environmental and societal impacts (Jain, Ahlstrom, 2021).

Sustainability is usually understood through its social, economic, and environmental dimensions (Kuhlman, Farrington, 2010). Social sustainability is about people’s wellbeing, participation, and the utilization of local laborers and firms. In contrast, economic sustainability is about the efficient
use, reuse, and recycling of resources to maximize market value. As another alternative, environmental sustainability involves caring for the ecosystem (e.g., energy, land, and water) and its limited capacity while emphasizing the quality of human life (i.e., air quality, human health) (Olawumi, Chan, 2018). Legitimacy in sustainable development is viewed as the general assumption by a firm’s stakeholders that their actions authentically respect the three components of sustainability (i.e., environmental stewardship, social equity, and economic performance) (Crespin-Mazet, Dontenwill, 2012). Legitimacy linked to sustainability is a resource created and used by firms to develop sustainable business models across overlapping business ecosystems (i.e., organizations, customers, policies, management systems, and technological platforms) (Press et al., 2020). Technologies with increasing needs for resources or with negative externalities may provoke their institutional misalignment (e.g., with environmental and societal values), thereby weakening their legitimacy (Markard et al., 2020).

The next section explores the potential of NFT technology to contribute to sustainability challenges by uncovering its key attributes, which may offer opportunities for NFTs as a sustainability-oriented technology.

**NFTs, a Radical Technology in the Quest for Sustainability and Legitimacy**

NFTs are digital assets materialized as units of data stored on a blockchain. They are a radical technology (Wilson et al., 2022), with properties that are key to providing functionalities and benefits for all stakeholders and industries (see Appendix 1), ranging from the brands that sell them to the customers who buy them (Wang et al., 2021). NFTs rely on decentralized systems called blockchains (Karapapas et al., 2021; Lee, 2021), a technology viewed as “tamperproof” and “immutable,” therefore bringing trust (Tan, Saraniemi, 2022) and a secured environment in which smart contracts can be executed (Bowden et al., 2018).

Existing research on NFTs can be organized into three main categories. The first research category has explored NFTs as alternative finance, comparing them with existing financial assets (Schaar, Kampakis, 2022) or considering them as standalone assets (Colicev, 2022). NFTs in this case are used as net absorbers of systemic risk, such as gold, and are recognized as safe-haven assets (Aharon, Demir, 2021). However, NFT prices are sensitive to their features (Dowling, 2021) and are highly volatile, which means that they run huge financial risks for investors (Grobys, 2021; Wilson et al., 2022).
The second research category has focused on value creation in the creative industries (Chalmers et al., 2021; Kugler et al., 2021; Malik et al., 2023; Valeonti et al., 2021) and event ticketing (Fan, 2019; Regner et al., 2019) as an extension of art. NFTs in this sense allow artists to gain their independence from galleries while having direct access to their audiences. This technology thus enables the tokenization of assets and royalties on second sales (Chandra, 2022; Regner et al., 2019). Transaction costs decrease and lead to new business models for artists (Malik et al., 2023) and museums (Valeonti et al., 2021). NFTs increase creators’ bargaining powers and fair revenue sharing (Chevet, 2018). Accordingly, artists are enthusiastic about NFT technology and how it empowers individuals to express their creativity and pursue new business models of content creation (Sharma et al., 2022). Studies in this vein also refer to technology, scarcity, and uniqueness as NFTs’ sources of value for customers (Chohan, Paschen, 2023).

The third research category has considered NFTs’ opportunities and threats for marketers and entrepreneurs, regardless of the industry field (Chohan, Paschen, 2021; Colicev, 2022; Hofstetter et al., 2022; Peres et al., 2022). NFTs are not limited to art (Pinto-Gutiérrez et al., 2022) and are transforming businesses and management practices (Anjum, Rehmani, 2022). NFT features, such as uniqueness, scarcity, and their capacity to build communities and develop a sense of belonging, provide many business opportunities (Colicev, 2022); as such, NFTs have societal benefits (Sharma et al., 2022). For instance, they bring authenticity, the pleasure of sharing, and the status of innovators to individuals (Hofstetter et al., 2022).

The dark sides of NFTs need to be highlighted as well, as this technology is related to numerous risks that are critical issues for all stakeholders (see Appendix 1). Copyright issues are important for brands (Kim, 2021), art, and museums (Valeonti et al., 2021), and due to legal pitfalls and policy issues, the regulation of NFTs can be a barrier. Current regulations for the NFT market belong to digital content directives (Goanta, 2020), which push for more transparency and the disclosure of practices to protect customers and creators. Nevertheless, these regulations hardly prevent law infringement (Cornelius, 2021). Taxation is another issue of concern to emphasize. Today, NFT sales remain outside of the Internal Revenue Service, but some countries (e.g., Philippines) want to integrate NFT profits from play-to-earn into income revenues (Francisco et al., 2022). In the future, it is likely that NFT-for-NFT, NFT-for-IP, and Eth-for-NFT, or vice versa, may be taxed, which should decrease speculation. For now, these technical and legal risks have led to many scams and thefts. Furthermore, NFTs face interoperability (or cross-chain) issues. As blockchains act as systems isolated from each
other, it is not possible to sell, buy, or trade one NFT belonging to a blockchain with another NFT belonging to another blockchain (Fan, 2019). This issue may slow the impetus for NFT success. While interoperability can be implemented by a third trusted party acting as a hub by deleting the decentralized property (Wang et al., 2021), solutions may come from third parties in opposition to the decentralized spirit of the founding fathers. Along with limited scalability, security, and regulation issues (Fröhlich et al., 2021; Regner et al., 2019), blockchains are also gas consuming (Wang et al., 2021) and are hardly compatible with sustainability and Corporate Social Responsibility (Dal Mas et al., 2020). Even with the recent Merge of Ethereum, which drastically reduced energy consumption, environmental considerations still cause great controversy, notwithstanding a few studies that view NFTs as having the potential to lead to sustainable business models (Dal Mas et al., 2020), which place undue emphasis on their great business model innovation power (Li, Chen, 2023).

Many components have laid the foundation for the legitimation of NFTs (see Table 1). The institutional pillars were first mainly regulatory (e.g., blockchain, digital wallets, and cryptocurrencies) and normative (e.g., smart contracts and platforms), especially through the proof-of-work and peer-to-peer mechanisms (Sharma et al., 2022). The success of these NFT categories has evolved with time. Different indicators can capture their taken-for-granted dimension, which include the transaction volume, the number of transactions, and their pragmatic dimension (i.e., the value of the NFT and the number of times one NFT is sold).

**Table 1 – Four pillars of technology legitimacy and NFT indicators**

<table>
<thead>
<tr>
<th>Technology legitimacy pillars</th>
<th>Regulatory</th>
<th>Normative</th>
<th>Cognitive</th>
<th>Pragmatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFT indicators</td>
<td>Laws</td>
<td>Certification</td>
<td>Common beliefs</td>
<td>Autonomy</td>
</tr>
<tr>
<td></td>
<td>Sanctions</td>
<td>Accreditation</td>
<td>Shared action logics</td>
<td>Transparency</td>
</tr>
<tr>
<td>NFT foundations</td>
<td>Blockchain</td>
<td>Smart contracts</td>
<td>Sales in volume</td>
<td>Number of times the same NFT is sold</td>
</tr>
<tr>
<td></td>
<td>Cryptocurrencies</td>
<td>Platforms</td>
<td>Number of transactions</td>
<td>Value of NFT</td>
</tr>
<tr>
<td></td>
<td>Digital wallets</td>
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</tbody>
</table>

Source: Authors

Overall, existing research has emphasized some economic and social benefits provided by NFTs. This radical technology offers new sources of financing for innovation and creativity (Stefani et al., 2020), while shaping new social norms by increasing the social legitimacy of virtual goods.
These benefits are balanced with ongoing environmental sustainability concerns linked to blockchain technology (Truby et al., 2022), as well as social equity issues identified in the NFT market (Zhong, Hamilton, 2023). Nevertheless, NFTs are still complex, opaque, and difficult to understand (Kondrateva et al., 2022), thereby raising many legal and regulation issues (Cornelius, 2021) and tensions among stakeholders (Wilson et al., 2022). These concerns have caused many to question the cognitive, normative, regulatory, and pragmatic dimensions of technology legitimacy (Dehler-Holland et al., 2022).

**Empirical Part**

**Methodology**

Legitimacy is a multidimensional concept linked to a variety of stakeholders. To examine this complexity, a qualitative analysis was used to explore the role of sustainability in gaining and maintaining technology legitimacy within NFT projects. Semi-structured face-to-face interviews were conducted between September and November 2022 (lasting 45 minutes on average) among subject-matter experts using a snowball approach, as NFT-based activities are still quite scant (see Appendix 2). Experts were asked general questions related to NFTs in a sustainable context. The interview guideline was divided into three parts: (1) their perception of the NFT technology; (2) the benefits, risks, and barriers to its adoption; and (3) current and future perspectives of NFT projects. Each researcher read all the transcripts to reveal how the experts expressed their perceptions regarding the sustainability dimension of NFT projects. A first-cycle coding process was initiated to summarize segments of the data. A causation coding was used by assigning sustainability-related labels to the data (Miles et al., 2020). Additionally, each researcher drafted an analytic memo narrating their reflections and thinking processes regarding the data collection and condensation, analysis and display, and conclusion drawing (Saldaña, 2021). The cross-comparison of memos allowed the researchers to structure the second-cycle coding (i.e., pattern doing) and improve the intercoder reliability. A network display was adopted to analyze the process of representing the role of sustainability in the legitimacy of NFT projects (Miles et al., 2020).

**Findings**

The findings highlight three main ways in which sustainability comes into play in the legitimation of NFT projects. Indeed, the results show that
the sustainability pillar of legitimacy can be inherent to the NFT project itself. The legitimacy of NFT projects can also be derived from the perceived sustainability of NFT technology. Sustainability as a legitimating factor for NFTs can also take on social, economic, and marketing dimensions, especially when considering the business models of NFT projects. We hereafter examine the three main ways in which sustainability participates in the legitimation of NFT projects.

**Sustainability Is Inherent To the NFT Project and Directly Participates In Its Legitimacy**

The participants provided several examples of how sustainability represents a major component of NFT projects. For instance, the participants mentioned cause-related marketing, especially fundraising activities through NFTs (R1); they also mentioned NFT projects with educational purposes (R2) or those used for health-related issues (R1). Another respondent explained how they developed NFTs to raise awareness related to the disappearance of bees (R6). Finally, other NFT projects mentioned were related to the depollution of oceans or different fundraising efforts in Africa (R7).

**Illustrative quotes: NFT projects with a sustainable dimension**

<table>
<thead>
<tr>
<th>Cause-related marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Fundraising activities: “Thanks to digital technologies, we can engage in fundraising activities to serve causes in a very rapid and efficient way” (R1).</td>
</tr>
<tr>
<td>- Grocery stores: “At Carrefour, we have issued NFT Bees to raise awareness of the disappearance of bees. It is a game, and a €15 NFTs are used to raise money for charities working on this cause” (R6).</td>
</tr>
<tr>
<td>- Pollution: “NFTs also raise funds like Aquaverse to clean up the oceans” (R7).</td>
</tr>
<tr>
<td>- NGOs: “Medusa World is a project whose objective is to sell NFTs and donate the money raised to NGOs in Africa” (R7).</td>
</tr>
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<thead>
<tr>
<th>Health</th>
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<tbody>
<tr>
<td>- “Regarding health, we could imagine the democratization of remote medical consultation, which could be applied via high-performance avatars serving as doctors for benign diseases” (R1).</td>
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<tr>
<th>Metaverse and education</th>
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<tbody>
<tr>
<td>- “At Mainbot, we have launched ‘Winkyverse’, an educational metaverse” (R2).</td>
</tr>
</tbody>
</table>

The diversity and scope of such projects reinforce the growing importance of the sustainability dimension within NFT projects and lead to further questions regarding how sustainability contributes to the legitimacy of NFT projects. Most respondents compared NFT projects with a sustainable dimension to past practices. Such comparisons represent a means of bringing legitimacy to those NFT projects. Indeed, comparing the old and the new is a way to highlight the benefits of these NFT projects. For instance, one participant discussed how NFTs have replaced traditional crowdfunding campaigns (R7). Along the same lines, NGOs were described as using NFTs...
for their fundraising activities, whereas they received traditional checks in the past (R1). Another example is the role of NFT in allowing artists to send messages with a societal component. An NFT can indeed reach newer targets in comparison to traditional displays (e.g., artistic galleries, libraries, museums, etc.) (R7). Overall, sustainable-based NFT projects are legitimized, as the NFT dimension is perceived to provide greater benefits in comparison to older/traditional dimensions and means.

<table>
<thead>
<tr>
<th>Illustrative quotes: Legitimation of NFT projects by comparing the sustainability of traditional vs. NFT-related initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundraising</strong></td>
</tr>
<tr>
<td>“Raising funds is now much faster compared to the older fundraising practices, such as sending a check to NGOs, as it happened 25 years ago” (R1).</td>
</tr>
<tr>
<td><strong>Crowdfunding</strong></td>
</tr>
<tr>
<td>“NFTs replace crowdfunding. Through the DAO (Decentralized Autonomous Organization), everyone is allowed to get involved, to be active, and to realize their values. To act!” (R7).</td>
</tr>
<tr>
<td><strong>Art</strong></td>
</tr>
<tr>
<td>“At school, we studied digital arts a lot because it is the art of our time. Before, we only had brushes, a canvas, and a hammer to sculpt, but today, we have a field of possibilities with digital technologies” (R7).</td>
</tr>
<tr>
<td>“Moreover, the internet allows for global diffusion and the capacity to reach even more people than do galleries, bookstores, artists and museums” (R7).</td>
</tr>
</tbody>
</table>

Sense-making represents an additional means when considering the sustainable dimensions of NFT projects. Sense-making can be societal or transformational (R7). Regarding art projects, NFT represents a new means for artists to provide a message and express themselves (R7). Art-based NFT projects even represent a form of activism, with respondents even using the term “green activists” (R7).

<table>
<thead>
<tr>
<th>Illustrative quotes: Legitimation of NFT projects through sense-making of their sustainable dimension</th>
</tr>
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<tbody>
<tr>
<td><strong>Societal transformation</strong></td>
</tr>
<tr>
<td>“At the time of the war, Picasso painted Gernica. We develop NFTs to attract attention, to raise awareness, to touch others, and to raise consciousness” (R7).</td>
</tr>
<tr>
<td><strong>Activism</strong></td>
</tr>
<tr>
<td>“It is a form of activism ... we now talk about ‘green activists’” (R7).</td>
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<tr>
<td>“It is necessary to be part of a green approach” (R1).</td>
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</tbody>
</table>

**Sustainability Is Part of the Technology Used to Legitimize NFT Projects**

As mentioned in the theoretical section, technology is an important dimension of the legitimacy of NFT projects. In this light, the results showed that sustainability is an inherent part of the technology legitimacy of NFT projects. The way the respondents brought support to the technology
The legitimacy of NFTs was to compare its sustainability to more traditional technologies. This comparison aimed to highlight the superiority of NFTs over other technologies when we consider their sustainability. Such comparison is done on several levels (see Appendix 3 for the Verbatim).

For instance, respondents compared the sustainability of NFT projects with other technologies, such as emails, data centers, and QR codes (R2). They also referred to hardware and explained that NFTs require no additional equipment in comparison to other technologies (R3). Respondents finally mentioned broadly accepted standards, such as the carbon footprint, as an external source for comparing the sustainability of NFTs with that of other technologies (R1). When it comes to green finance, blockchains, and smart contracts, the respondents compared the sustainability of NFTs to that of other payment norms, standards (SWIFT), and tools (Paypal) (R3 and R4).

The respondents also highlighted the double-edged effect of technology legitimacy when they referred to the dark side of NFT technology legitimacy. Indeed, on the one hand, the respondents explained that NFTs are based on principles such as empowerment, decentralization, fairness, inclusive governance (R3 and R4), and digital sobriety (R5). On the other hand, they described how the NFT as a technology is complex, which might bring confusion to the stakeholders who end up not positively perceiving the sustainability dimension. In addition, NFTs were seen as a kind of Wild West characterized by scams, bashing, fraud, and swindling (R4; R5; R6).

**Illustrative quotes: Comparison to other technologies**

- “Let’s stop stigmatizing technologies without a complete carbon footprint. How many times at a restaurant is a waitress happy to present a QR code in place of a paper menu, claiming that it is green? This remains to be proven” (R2).
- “You should know that to mint an NFT consumes 40 times less energy than an hour of YouTube video” (R5).
- “When in the 60s, Kennedy was able to launch the space program, no one asked the question of energy consumption and the contribution to the common good!” (R6).

**Sustainability Is Part of the Business Model of NFT Projects**

The results show that new business models based on sustainability represent a new anchor point for the legitimacy for NFT projects. In this vein, the respondents mentioned the societal, economic, and marketing benefits of NFTs’ business models, which greatly supported their legitimation (see Appendix 3 for the verbatim).

The societal benefits of NFTs’ business models are numerous. First, NFTs possess an inherent social dimension. For instance, they preserve and
guarantee the copyright and authorship of an artist or inventor (R2). Second, there is a *fairer distribution of value* among the different players that better corresponds to the contribution of each player to the overall value created (R4). Third, through the specificities of NFTs, there is also *more inclusion* via Decentralized Autonomous Organizations (DAOs), meaning that people are involved in their governance (R4). Fourth, an NFT creates a community and a *sense of belonging* for all the actors involved (R3). Finally, NFTs allow for *empowerment* (R4). Overall, the NFT business model is more *ethical, inclusive, and fair*, according to the respondents.

There are also various *economic benefits to NFTs’ business model*. First, there are no entry barriers (R2 and R3) and no intermediaries (R3). Second, NFTs are characterized by *transparency, freedom, autonomy, and independence for their creators*. Economically, it is less expensive because there is no need to pay intermediaries, and transfers are supposed to be secure through the blockchain (R3). The *balance of power with GAFAM is reversed*, which allows for a *redistribution of wealth, decentralized governance, and greater transparency* (R3). In addition, NFTs allow individuals to invest in decentralized finance without the traditional banking system. NFTs are a great opening toward new, innovative, and more participatory and therefore inclusive business models, which encompass both the social and economic pillars of sustainability (R5).

Finally, there are some *marketing benefits to NFTs’ business model*. For new ventures with no network and no reputations yet established, NFTs are a key differentiating factor. The virtual offering or product makes it possible to position oneself in a niche market or as an *innovative brand* (R3). Indeed, NFTs allow *communities to access exclusive content* (R3).

**Illustrative quotes: Sustainability is part of the business model of NFT projects**
- “Anyone can create NFTs, there are no entry barriers... NFTs are more social and also allow for more ethical business models” (R2).
- “NFTs represent freedom, autonomy and independence for creators, as well as participative governance, the reversed balance of power with GAFAM, a redistribution of wealth, decentralized governance, and transparency” (R3).
- “NFTs are a great opening toward new, innovative, and more participatory and therefore inclusive business models” (R5).

**A Sustainability-Based Model of Technology Legitimacy**

Based on the phases of the legitimation of new technologies (Johnson *et al.*, 2006), our results highlight how sustainability has been a significant factor in the legitimation of NFT technology through the following four stages: (1) innovation was reflected in the creation of the NFT technology; (2) local validation was achieved through activism, especially green forms of
activism; (3) diffusion occurred through a diverse portfolio of industries and sectors, such as NGOs, health, education, and art; and (4) general validation occurred through sense-making activities, with a societal and transformational dimension (see Figure 1).

Following Bergek (2019), Figure 1 also highlights that the legitimation of the NFT as a new technology depends on its perceived benefits compared to alternative technologies. We found that NFT projects are legitimated when they offer superior advantages in comparison to past sustainable mechanisms and alternative sustainable technologies and standards. The results ultimately show that sustainability is part of the social, economic, and market benefits of NFT projects. Such benefits greatly impact the legitimation of NFTs, as they offer new rules of the game (e.g., decentralized governance, fairer distribution of wealth and value, inclusive business models, etc.).

**Figure 1 – A sustainability-based model of technology legitimacy of NFTs**

**Past & alternative sustainable technologies & mechanisms of NFTs**
- Cause related marketing
- Crowdfunding
- Communication (Media)
- Sustainability standards & measures (carbon print)

**Technology Legitimation of NFT project**

1. **Stage 1: Innovation**
   - NFT projects

2. **Stage 2: Local validation**
   - NPOs
   - Green activism

3. **Stage 3: Diffusion**
   - NGOs
   - Education
   - Health
   - Art

4. **Stage 4: General validation**
   - Sense-making
   - Societal
   - Transformational

**Perceived sustainability benefits of the NFT project**
- **Social benefits**
  - Inclusion
  - Fairer distribution of value & wealth
  - Ethical
  - Empowerment

- **Economic benefits**
  - Decentralized governance
  - Transparency
  - Freedom
  - Autonomy
  - Reversal power of the GAFAM
  - No intermediary
  - Independence

- **Market benefits**
  - Community
  - Innovative brand
  - Sense of belonging

_Sources: Authors_

**Discussion, Contributions, and Implications**

This paper aimed to explore the role of sustainability in gaining and maintaining the technology legitimacy of NFTs. Based on the findings of the exploratory research, a framework (Figure 1) is suggested that highlights the role of sustainability in legitimizing NFT projects.

Overall, the findings suggest that the sustainability dimension within NFT projects has the potential to be more than just a tool for technology legitimacy. Generally, our results shed some important light on the underlying
process of the legitimation of new technologies (Bergek, 2019). When considering the role of sustainability, the findings show that a new technology is legitimized when it offers advantages in comparison to past mechanisms and alternative technologies. The results also show that technology legitimacy is derived from its perceived benefits. We found that sustainability is part of the social, economic, and market benefits of NFT projects and participates in their legitimation. The results further reveal that NFT projects are guided by the principles of inclusivity, redistribution of wealth, decentralized governance, and greater transparency. These societal benefits of NFTs (Sharma et al., 2022) encompass ethical and sustainability-based characteristics that participate in legitimating NFT projects. NFTs also represent an opportunity to create new business models, which is an opportunity for the entire tech and sustainable ecosystem. However, their inherent technological complexity needs to be considered. In addition, ethical and societal drawbacks, as well as economic risks, also require particular attention to ensure that technological legitimacy is both gained and sustained for NFT projects.

These findings highlight the unique combination of technology legitimacy pillars (Dehler-Holland et al., 2022; Markard et al., 2016). First, all respondents agreed that the issue of sustainability is especially relevant to the legitimize NFT projects. Second, all respondents mentioned the double-edge effect of legitimacy (e.g., “I think that the question of NFTs and sustainability is mainly comprised of criticism”, R6). NFTs benefit from both positive and negative spillovers from past and alternative technologies and mechanisms. Such dynamics simultaneously represent legitimacy anchor points and challenges. For instance, the interviewees raised the issue of what they called “NFT bashing” (R5), as if NFTs were responsible for all the pollution of the internet (e.g., “In short, the NFT was tainted at birth by suspicion of being energy-intensive”, R6), which can hamper the cognitive dimension of technology legitimacy. To overcome these legitimacy challenges, participants compared NFTs to other more problematic technologies (e.g., “An NFT consumes 40 times less energy than an hour of a YouTube video”, R5).

The participants also mentioned the current lack of regulations and standards in the virtual sphere, which challenges the regulatory pillar of legitimacy. The institutional vacuum inherent in new technologies and industries leads to potentially deviant opportunistic behaviors and speculation. The blockchain represents a solution to such an institutional void. Through decentralization, blockchain technology brings security, disclosure, and transparency among the different stakeholders. This actively participates in the sustainable and ethical dimensions of NFTs and ultimately confers regulatory technology legitimacy. The participants also agreed that in finding
their own interests in NFT projects, all stakeholders participated in their deployment, ultimately conferring pragmatic legitimacy (e.g., “Anyone can create NFTs; there are no entry barriers, so NFTs are more social and also allow for more ethical business models”, R2). The NFT technology brings all players of the value chain together (e.g., “The DAO contributes to federate a community and to act together”, R7). This technology is more participatory and inclusive, which reinforces the pragmatic pillar of legitimacy (e.g., “NFTs create a community and a sense of belonging”, R3).

The double edge of technology legitimacy also exists on the normative pillar. On the one hand, “as in every new industry, the scam is important” (R4). On the other hand, the NFT technology aligns previously informal norms (i.e., green activism) with formal standards. Smart contracts and digital wallets bring security (e.g., “Players like PayPal will help make the market more secure for users”, R4). Normative legitimacy is also conferred through mechanisms that bring trust and credibility (e.g., “Transparency, freedom, autonomy, independence, and participative governance”, R3).

Table 2 depicts the sustainability of NFT projects for each technology legitimacy pillar.

Table 2 – Sustainability in NFT projects for each technology legitimacy pillar

<table>
<thead>
<tr>
<th>Dimensions of technology legitimacy</th>
<th>Regulatory</th>
<th>Normative</th>
<th>Cognitive</th>
<th>Pragmatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFTs Anchor-points, challenges of technology legitimacy</td>
<td>Institutional void Current regulations for NFTs market belong to digital content directives: - General Data Protection Regulation (GDPR) in Europe - California Consumer Privacy Act (CCPA in the US) - Both push for more disclosure and transparency of practices to protect customers and creators</td>
<td>Pandemic NFTs acted as net absorbers of systemic risk NFTs recognized as safe-haven assets Smart contracts Digital wallets</td>
<td>Trust-based Credibility of NFTs projects owners: - Celebrities - Brands - Sport teams</td>
<td>Trust-based DAO Sense of belonging Community Empowerment Inclusivity</td>
</tr>
</tbody>
</table>
Theoretical Contributions and Managerial Implications

This research has several theoretical contributions, as well as managerial and business policy implications. From a theoretical perspective, we contribute to the innovation literature, especially through the technology legitimacy lens (Geels, 2018; Geels, Verhees, 2011). Past work has emphasized the paradoxical tensions between the potential costs and benefits created by distributive technologies (Ferreira et al., 2023). The findings presented here show that part of radical innovation needs to conform, or at least be compared, to existing social norms and values. Indeed, the legitimacy of a new technology is derived from its comparison to existing technologies and their potential lack of or failed legitimacy. The results also highlight how nascent technology needs to be associated with a new business model to acquire technology legitimacy in the eyes of the beholders. Therefore, it is only by balancing current and new frameworks and by managing contradictory pressures that NFTs as a new technology will be perceived as appropriate and desirable by the main evaluating audiences (Weiss, Nemeczek, 2021).

We also contribute to the field of sustainability transition studies (Markard et al., 2016; Markard, 2020). The dark side of radical technologies threatens their quest for legitimacy (Calma, 2021). In line with past studies (Crespin-Mazet, Dontenwill, 2012), the findings showed that the three pillars of sustainability (i.e., environmental stewardship, social equity, and economic performance) strongly participate in the legitimation of NFT projects. When it comes to the environmental dimension, sustainability concerns are either inherent to the technology (e.g., NFT pollutes less, or an NFT needs no additional equipment) and/or are the “raison d’être” of the NFT creation.
(e.g., ecological, or environmental purposes). The present study also enriches past research showing the social value (Vick, 2022) and social impact (Cryptoaltruism, 2022) of NFTs. Indeed, it is not only the value created, but rather how such value is distributed among players along the chain that truly matters. Finally, for the economic pillar (Press et al., 2020), the findings show that sustainability participates in legitimizing NFT projects through innovative business models and market-based initiatives.

This research has several managerial implications. First, sustainability is of great importance to establishing, developing, and consolidating technology legitimacy. Firms evolving into all types of industries face legitimacy challenges when they initiate NFT projects. These firms can now rely on the four pillars of technology legitimacy to gain and maintain the support of their stakeholders. Second, our results show that the sustainability of NFT projects encompasses societal, technological, economic, business model, and marketing elements, which represent legitimacy anchor points. Finally, the findings have some implications for new ventures, as sustainability has been found to accelerate technology legitimacy through market-based dynamics.

This article also has business policy implications. Indeed, regulatory bodies have played a major role in this recent industry. Both international and local bodies have had an impact not only on the technological level, but also on the sustainable one. In particular, the NFT has recently faced legitimacy challenges, leading to uncertainty and raising new questions from all players. Policymakers can effectively secure the market with a portfolio of actions to be undertaken.

**Conclusion**

Overall, the three components of sustainability (i.e., environmental stewardship, social equity, and economic performance) (Crespin-Mazet, Dontenwill, 2012) greatly participate in building the four pillars of technology legitimacy for NFT projects (Dehler-Holland et al., 2022; Markard et al., 2016). Past work has emphasized the double edge of legitimacy (Ashforth, Gibbs, 1990) and the dark side of NFTs from sustainable (Calma, 2021; Garnett, 2022) and/or ethical perspectives (Chainalysis, 2022). This paper adopts the perspective of sustainability as a means to uncover the technology legitimacy challenges in the context of NFT projects. In other words, our research objective was to explore the double edge of legitimacy for NFTs by unveiling the role of sustainability and adopting technology legitimacy as a theoretical lens.
This research contributes both to the nascent literature on technology legitimacy and to the field of sustainability transition studies. Our findings show that sustainability plays a major role in the technology legitimacy of NFT projects. First, the inherent sustainability dimension of NFT projects represents a key factor for audiences to grant technology legitimacy to those projects. Second, our results uncover the dynamics behind technology legitimacy. Indeed, the qualitative study highlights the fact that audiences compare the sustainable dimensions of NFT projects to those of traditional projects to legitimize the former against the latter. To put it differently, technology legitimacy comes from comparing the old and the new. Finally, technology legitimacy is derived from the Business Model of NFT projects and their sustainable specificities. The results thereby emphasize the societal, economic, and market dimensions of such business models.

New studies could analyze technology legitimacy in other industries. Indeed, the respondents highlighted how different legitimation dynamics, such as cause-related marketing, education, art, or finance, allow NFT projects to follow different legitimacy paths when integrating the sustainability dimension. In addition, future work could integrate the generational dimension. In fact, Gen Z, also known as millennials and digital natives, may exert specific behaviors regarding NFT projects. Nevertheless, the results also show certain specificities when it comes to sustainability and technology. On a methodological level, future research could proceed with secondary data, such as media, which could enrich the present findings, as they would involve external stakeholders. Annual reports, as internal sources of information, could also provide new insights. A quantitative study would also deepen our understanding of the process of securing technology legitimacy for NFT projects and the role of sustainability.

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Appendices

Appendix 1 – NFT properties, opportunities for industries, and security issues (adapted from Abbate et al., 2022; Arcenegui et al., 2021; Chen, 2018; Jennath et al., 2019; Wang et al., 2021).

<table>
<thead>
<tr>
<th>NFTs properties</th>
<th>Verifiability</th>
<th>Ownership of NFTs can be publicly verified. Authenticity is provided.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent execution</td>
<td>All NFTs activities such as minting, selling and purchasing are publicly accessible.</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>As NFTs never goes down, they are always available to sell and buy.</td>
<td></td>
</tr>
<tr>
<td>Tamper-resistance</td>
<td>Once the transactions are confirmed, trading records are persistently stored and cannot be manipulated.</td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>NFTs’ ownership information is always user-friendly and clearly known.</td>
<td></td>
</tr>
<tr>
<td>Atomicity</td>
<td>Trading NFTs can be done in one-atomic isolated transaction.</td>
<td></td>
</tr>
<tr>
<td>Tradability</td>
<td>As long as there is a buyer, all NFT can be traded and exchanged.</td>
<td></td>
</tr>
</tbody>
</table>
### NFTs opportunities for industries

| **Gaming industry** | NFT benefit to the entire ecosystem. Crypto games are booming. NFTs have lead games to economically status: Cryptokitties, Cryptopunks and Axie Infinity are genuine examples. Through limited and rare collections, large amounts of money were spent. NFTs can be functional items such as skins and weapons that brings players power and benefits. NFTs can be redeemed through play-to-earn mechanisms. |
| **Raising money** | NFTs are used in Initial Coin Offering (ICO), Initial Farm Offering (IFO), and Initial Exchange Offering (IEO) thanks to uniqueness ownership authentication. Disintermediation allows stakeholders (e.g., celebrities, artists) to interact directly with their audiences, display and sell directly their piece of arts (e.g., music, painting, funny stories, time with a sportsman). Instead of using platforms such as Deezer and Spotify that keeps most of the profit, the decentralized mechanism of NFTs enables retraining most of the revenues. NFTs can also NFT can be programmed so that artists / creators get a predetermined fee when their masterpiece is sold or exchanged. |
| **Investing the metaverse** | Metaverse such as Sandbox, Decentraland or Roblox are virtual worlds where users can interact and experience enhanced life. Some buy luxury brands (e.g., the Gucci bag). Others invest in lands, buildings and yachts. Users like to show they belong to the NFT revolution and are proud to be first to invest in metaverse. Their investment can also prove to be financially effective, through leasing or trading with benefits. |
| **IoT wide adoption** | Internet of Things (IoT) means that any devices or objects can be interconnected through the internet in order to collect, interact, broadcast and share data. Thanks to blockchain account and a private key, NFTs allow a unique identifier to link a possession and its owner. Tokens and devices can have a univocal relation. Hence, NFTs may provide secure trustworthy environment to develop IoT. Using the programming language Solidity, IoT may thrive. A use of NFTs can be powered paring in smart cities. Each parking lot will be represented by a NFT, managed by smart contracts. Finding a vacant parking lot and generating revenue for its owner would bring value for all stakeholders. |
### NFTs Security Issues

<table>
<thead>
<tr>
<th>Issue</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spoofing</strong></td>
<td>Attackers may exploit authentication vulnerabilities and steal users' private key. Using a cold wallet to prevent key leakage or making a formal check on the smart contract may impede spoofing.</td>
</tr>
<tr>
<td><strong>Tampering</strong></td>
<td>Data stored outside the blockchain may be manipulated. To avoid that, sellers must send both the original data and hash data to the NFTs buyers.</td>
</tr>
<tr>
<td><strong>Repudiation</strong></td>
<td>Hash data may bind with attackers’ address. Using a multi-signature contract may be a solution.</td>
</tr>
<tr>
<td><strong>Information-disclosure</strong></td>
<td>Attackers break the confidentiality of transactions by linking to other buyers and sellers. Privacy-preserving smart contracts protect users' privacy.</td>
</tr>
<tr>
<td><strong>Denial of service</strong></td>
<td>NFTs data may not be available. A hybrid blockchain architecture may solve the problem.</td>
</tr>
<tr>
<td><strong>Elevation of privilege</strong></td>
<td>Related to authorization, attackers may gain permissions beyond those initially granted. Verification of smart contracts is necessary.</td>
</tr>
</tbody>
</table>

### Appendix 2 – Profiles of the respondents

<table>
<thead>
<tr>
<th>No</th>
<th>First name</th>
<th>Age range</th>
<th>Gender</th>
<th>Professional domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Édouard</td>
<td>25-34</td>
<td>M</td>
<td>CEO and cofounder, blockchain business</td>
</tr>
<tr>
<td>2</td>
<td>Loïc</td>
<td>18-24</td>
<td>M</td>
<td>Co-founder and CEO of NFT clothing company</td>
</tr>
<tr>
<td>3</td>
<td>Allison</td>
<td>35-44</td>
<td>F</td>
<td>Marketing manager, metaverse growth</td>
</tr>
<tr>
<td>4</td>
<td>Titou</td>
<td>18-24</td>
<td>M</td>
<td>Staff of NFT Factory</td>
</tr>
<tr>
<td>5</td>
<td>Thomas</td>
<td>35-44</td>
<td>M</td>
<td>Marketing manager, metaverse growth</td>
</tr>
<tr>
<td>6</td>
<td>Gilles</td>
<td>44-53</td>
<td>M</td>
<td>Business angel in NFT and blockchain companies</td>
</tr>
<tr>
<td>7</td>
<td>Charles</td>
<td>35-44</td>
<td>M</td>
<td>CEO and cofounder, blockchain company</td>
</tr>
<tr>
<td>8</td>
<td>Stéphane</td>
<td>45-54</td>
<td>M</td>
<td>Cofounder of consulting agency for luxury goods using NFT</td>
</tr>
<tr>
<td>9</td>
<td>Aris</td>
<td>18-24</td>
<td>M</td>
<td>Co-founder of NFT consulting company</td>
</tr>
<tr>
<td>10</td>
<td>Célim</td>
<td>18-24</td>
<td>M</td>
<td>Co-founder of NFT consulting company</td>
</tr>
<tr>
<td>11</td>
<td>Pauline</td>
<td>35-44</td>
<td>W</td>
<td>Manager, hospitality</td>
</tr>
<tr>
<td>12</td>
<td>Rémi</td>
<td>35-44</td>
<td>M</td>
<td>Manager, The Sandbox</td>
</tr>
</tbody>
</table>
Appendix 3 – Sustainability as part of the technology used to legitimize NFT projects

Verbatim - Sustainability is part of the technology used to legitimize the NFT projects

“We could imagine NFTs based on a carbon footprint or on a social impact that are sold on a secondary market, etc.” (R1)

“Let’s stop stigmatizing technologies without a complete carbon footprint. In restaurant, a waitress is happy to present a QR code in place of a paper menu claiming that it is green. This remains to be proven” (R2).

“The question of data that is public and belongs to everyone is also in favor of NFTs on the social level. Instead of having GAFAM that capture the value of personal data, they are now public. No one makes money on users’ accounts. I find it very fair” (R3).

“NFTs have an advantage for the environment, at least on the user side. They use already existing tools and objects such as laptops, computers, infrastructures. There is no need for new material investments, it is more sustainable” (R3).

“Do we really need to compare NFT with traditional currencies? Online payments via credit card or PayPal rely on telecom networks, computers, servers, storage spaces, etc. This is not sustainable. Think of the interbank SWIFT network too!! All these technologies consume a lot of energy.” (R3).

“NFTs are an opportunity for new business models ... for an artist who will create NFTs and be able to be better paid than via Deezer or Spotify and other intermediaries such as art galleries” (R4).

“Regarding green finance, standards are coming, uses are evolving for greater awareness. For example, there are more and more tools to analyze your carbon footprint” (R5).

“1.5 megabytes, at the individual level, is not much. This represents 1min spent on the news feed of a social network, or 12s of video, our data consumption continues to grow” (R5).

“We see aberrations every day, between the shops with open doors on the street to heat the street! And the desks lit all night!” (R5).

“I think that the question of NFT and sustainability is mainly comprised of criticism of IT consumption in general, from data centers to Metaverse. No one mentions the energy-intensive damages of transportation” (R6).

“When in the 60s, Kennedy was able to launch the space program, no one asked the question of energy consumption and contribution to the common good! Today we realize that there are too many objects in the atmosphere and that a risk of collision is very high. I am perfectly in favor of sustainability but the accusations are not targeting the right factors” (R6).

Verbatim - Sustainability is part of the business model of NFT projects
Verbatim - Sustainability is part of the technology used to legitimize the NFT projects

“You can create content on all social networks, Facebook, Instagram, Tik Tok, etc. but it does not belong to you. They capture the value. When you leave the platform, you lose everything! Yet you created the content. Worse, you lose your audience. It raises ethical questions. The NFT business model where the creator owns his work and has a direct link with his audience is much more balanced” (R2).

“For us, young people without a network and with a reputation to make, NFTs are a key differentiating factor” (R3).

“NFTs create a new business model. It also allows young people to get started, to have this added value. It encompasses both economic and social dimensions of sustainability” (R3).

“On the social level, NFTs represent the reversed balance of power with GAFAM, a redistribution of wealth. On economic level, it is less expensive ... we do not pay intermediaries, it is secure even if leaks exist. NFTs create a community, a sense of belonging. NFTs give creators an opportunity to capture their value without intermediaries” (R3).

“NFT prove that decentralized finance works and provides opportunities for action. NFTs represent new, innovative, and more participatory and therefore inclusive business models. It also means social, the second pillar of sustainability” (R5).

“The example of Absolute factory is bluffing. They can do targeting. It is fairer than through cookies and tracking people online. This is the future! Transparency, fairness, fair remuneration” (R6).

“At Carrefour, the blockchain guarantees confidence and quality to consumers. We have public data to support it” (R6).

“Transparency fights against ecological aberrations by shedding light on such irregularities” (R6).

“In the automotive industry, the Blockchain provides client service, security, trust and transparency” (R6).

“Young people need communities, they like to belong to a community to exchange and act, interact, share. DAO is the ideal tool” (R7).