

David Sarpong<sup>a</sup>, Email: [David2.Sarpong@uwe.ac.uk](mailto:David2.Sarpong@uwe.ac.uk)

Shi Dong<sup>b</sup>, Email: [Shi2.Dong@live.uwe.ac.uk](mailto:Shi2.Dong@live.uwe.ac.uk)

Gloria Appiah<sup>c</sup>, Email: [appiahg@roehampton.ac.uk](mailto:appiahg@roehampton.ac.uk)

*Authors Affiliation<sup>ab</sup>:*

Bristol Business School  
University of the West of England  
Bristol, United Kingdom

*Authors Affiliation<sup>c</sup>:*

Roehampton Business School  
University of Roehampton  
London, United Kingdom

## **‘Vinyl never say die’: The re-incarnation, adoption and diffusion of retro-technologies**

New technologies continue to shape the way music is produced, distributed and consumed. The new turn to digital streaming services like iTunes, Spotify and Pandora, in particular, means that very recent music format technologies such as cassettes and CD's have almost lost their value. Surprisingly, one 'obsolete' music format technology, Vinyl record, is making a rapid comeback. Vinyl sales around the world, in recent times, have increased year on year, and the number of music enthusiast reaching for these long-playing records (LP's) continue unabated. Drawing on the sociology of translation as an interpretive lens, we examine the momentum behind the revival of vinyl record, as a preferred music format choice for a growing number of music enthusiasts. In doing this we unpack the inarticulate and latent network of relationships between human and non-human actors that constitutively give form to the contemplative knowledge (what has become) of the resurgence of vinyl as a format of choice. We conclude by discussing how insights from the vinyl reincarnation story could help open up new possibilities for rethinking the contextual re-emergence of near-obsolete technologies, the mobilization of different actors to aid their re-diffusion and potential exploitation of value from retro-technologies.

Keywords: Actor network theory, diffusion of innovation, retro-technologies, Vinyl technology

### **Introduction**

Orwell was an articulate proponent of dystopian visions of the future. In the light of the emergence of digital streaming services like iTunes, Spotify and Pandora, he would have probably predicted that young music enthusiasts in this age would be scrambling for more advanced and sophisticated technologies to stream their music. Surprisingly, recent global music sales figures show that the 'obsolete' vinyl record is making a comeback [1,2]. Compared to CD and digital albums, the overall sale of vinyl is infinitesimal and account for only 2% of industry revenue. In this regard, vinyl sales remain a niche market as it does not capture a significant share of the global music sales. But

with a predicted year on year growth of 100% [2], the revival of vinyl as a format of choice for both young and old music enthusiasts in an era of digital streaming is intriguing as it represents a confounding retro-technology- an old and often displaced technology that regains a new lease of life to become part of nearly invisible everyday-life. The survival and resurgence of vinyl challenges traditional views on technological evolution and beats the imagination of technophiles whose prognosis predicted the total annihilation of vinyl LPs in the early 1990s [3-5].

In recent times, our understanding of the music enthusiasts' return to vinyl has therefore been extended as a result of some interesting lines of inquiry analysing the larger social, historical, and intellectual context within which vinyl has emerged as a preferred music format [6-9]. Among the plethora of factors cited as driving vinyl's renewed appeal and boom in vinyl sales include consumers demand for good-quality sound [6], its physicality, tactile and aesthetic appeal [10], and old-fashion consumerism [8,11]. However, there is no evidence to suggest that vinyl is en-route to capture a significant share of the global music sales market anytime soon [1,2]. Not all, we certainly cannot predict whether vinyl is poised to stay on the music enthusiasts' radar for the near future and beyond. Yet, tagging the conspicuous resurgence of vinyl as an insignificant phenomenon will mean its fecund progenerative potentialities on technology diffusion, and social change may escape the attention of decision makers who are expected to break out of dominant mindsets, and develop peripheral awareness of inarticulate and often invisible social currents. In this regard, we follow in the footsteps of other scholars such as [7,10,12], to argue that the resurgence and increasing adoption of near-obsolete technologies has some epistemological relevance to the management of technology in this digital age. This discursive positioning of retro-technologies is not simply of innovation. Rather, their uncanny reemergence has the potential to refashion discourse on novelty, technology diffusion and social change. Contributing to this line of inquiry, our objective in this paper is to extend our understanding of the resurgence and diffusion of vinyl technology and its potential implications for the management of retro-technologies across space and time. We do this analysing the 'reincarnation' of the vinyl as the music enthusiast's format of choice by attending to the social and technical aspect

of the technology together. Emphasizing the role of boundary objects which act as intermediaries in network relationships, the sociology of translation offers an alternative interpretive lens to unpack and critically evaluate the configuration of human and non-human actors in the transformation of the contingent and contextual meaning of innovation. We aim to make two contributions to the literature on the diffusion of retro-technologies in the following ways: First, while prior research has examined retro-technologies using the S-curve as a point of departure, this paper draws on the sociology of translation as an interpretive lens to explore the convergences of various actors in a way that gives form to the resurgence of vinyl technology as a format of choice. Second, it unpacks the mechanism that sustains the re-diffusion of vinyl as an everyday retro-technology. Two main advantages of using ANT could be seen for the purpose of this paper. First, it opens up new possibilities for rethinking the surge in the re-incarnation of old technologies by bring to fore the distributed interplay of humans and nonhuman actors in pursuing the establishment of irreversible and maintainable innovations. Second, it proposes one way of understanding technology, society, and relations among them by uncovering the mechanism translating the interest of heterogeneous actors and enrolling them into a socio-technical ensemble. We develop our contribution based on vinyl technology in the global music industry.

The paper is organized as follows. First, we provide a brief review of the literature on the emergence and re-diffusion of retro-technologies. Next, we present an overview of the re-emergence of vinyl technology as a preferred medium choice in music consumption. Following this, we draw on the sociology of translation as a meta-theoretical lens to unpack the circulation and adoption of retro-technologies in everyday life. In the penultimate section, we delineate how inarticulate and latent network of relationships between human and non-human actors gives form to the contemplative knowledge (what has become) on the resurgence of vinyl sales to explicate the intransitive mechanism sustaining the resurgence of vinyl sales in the music industry. We conclude the paper with a discussion of our thesis and its implications for theory and practice.

## **The emergence and diffusion of retro-technologies**

Promoting the S-curve as an organizing device to theorise the diffusion of innovation, the widely accepted dogma is that old technologies, processes or products will be replaced by newer ones as industry moves along the evolution wave; and there is no going back during this process [13]. From this perspective, Roger [14] identified knowledge, persuasion, decision to adopt, implementation and confirmation as the five fundamental stages through which innovations and technologies in general get adopted and diffused. Building on the work of Roger, Motohashi et al. [15] outlined the flow of the whole diffusion process: first an innovation has to be a major technological breakthrough; then the innovation has to be communicated to consumers through marketing channels; after that the innovation has to be commercialized and put into market; over time, the innovation gets accepted and diffused. While these studies have extended our understanding of the diffusion of technologies, they appear to be far removed from reality, where disrupted or 'old technologies' gain a new lease of life, get culturally revived, and re-diffused locally and in appropriate contexts [16, 17]. Consider, for example, the Swiss mechanical watch. This product and its technology, almost pushed to extinction in the 1970s by cheaper and more advanced quartz have enjoyed tremendous success in recent times. The European automobile industry has also seen a spike in the sale of the new Volkswagen Beetle and the Fiat 500 despite the deteriorating trading conditions for the whole industry [18]. Placing emphasis on the past, present and the future, a new stream of literature that examines retro-technologies have emphasized heritage [19, 20], revival of collective memories [21], strong nostalgic appeal [22], as the quintessential psycho-social factors reinforcing and enhancing the enduring appeal, adoption and diffusion of retro-technologies. Elsewhere, Brown et al. [23] observed that what is driving the re-emergence of old technologies are partly due to the contemporary turn to recreating the past for the present. This they argue involves the creative combination of past elements from prior periods with contemporary standards of performance, functioning or taste, and the proactive renewal of dormant elements which have strong appeal in today's society's' collective memory. In practice retro technologies tend to gain life and grow in niches or carved out protective spaces where the perceived

value, material and social logics of using the supposedly outdated technology trump new technologies [24]. Their diffusion requires an innovation of meaning of the technology, and the building of networks made up of actors bounded together by their socio-technical interest in the technology [25].

Recent theory in consumption studies has re-directed attention to new ways of understanding the reincarnation of retro-technologies. One of the most insightful studies emanating from this stream of literature is the work of Magaudda [7] which analysed the consequences of dematerialization of the practices of cultural goods consumption. Drawing on the theory of practice, the study shows how the appropriation the vinyl technology re-configures listeners' situated practices which in turn changes the subjective meaning of the value of materiality of the technology in everyday life. Magaudda's study shows that music digitalization does not mean less materiality in the actual practice of listeners, that material stuff still occupies a relevant position in the digital age. Paradoxically, as the process in which the reconfiguration of the relationship between materiality and culture leads to a renewed role played by material objects in people's life and activities, material stuff would play an even more essential role in consumer practices and life. On the surge in the appropriation of vinyl as a format of choice, Magaudda drawing on the contemporary turn to practices adopts what he called the "circuit of practice" as an organizing device to analyze the processes of change in consumption of vinyl in everyday life. The "circuit" is made up of the three elements of object, representation and doing, aiming at delineating the transformative process of reintegration of vinyl record in contemporary music consumption. the circuit starts from the spread of digital music and online music servers, which changes music-listening habits and devalues the authenticity of music-listening experience; the devaluation prompts the listeners towards the adoption of a more material form of music - vinyl record; this forms a process of reconfiguration of meanings, values and feelings around the use of the obsolete vinyl; finally the re-incarnation of vinyl as a socio-material musical practice is the basis for the development of new activities and behaviours, which involve the buying, listening, conservation and appreciation of vinyl.

While the marketing and innovation literatures offer some insightful pointers and subsidiary awareness of the reincarnation of old technologies [12,26-28], theoretical frameworks that show how the interaction among actors and artefacts, and the changes happening to all of them as a result of these interactions is sparse. In turn, we also lack conceptual innovations that analyse how different translation processes through which technologies, artefacts' and human actors interact to give form to the re-incarnation of old technologies. Our paper seeks to fill this gap by unpacking the differentiated inarticulate mechanisms and latent network of interdependent relationships that sustains the reincarnation of 'obsolete' technologies in everyday life. In the next section, we present an overview of the sociology of translation, also known as Actor Network Theory (ANT) as an interpretive package to explore the re-emergence of vinyl as a preferred format choice in the music industry.

### **Actor network theory and the diffusion of technologies**

Actor network theory (ANT) also referred to as the sociology of translation, is the science of associations that delineates the non-dualistic account of the temporal relations between science and technology [29,30]. From a philosophical and methodological perspective, it has been critiqued as anti realism and social constructivism [31,32]. This stems from ANTs focus on the fusion of human and nonhuman actors into networks, and mobilized actors engaged in collective action to realise an individual or collective interest. Thus, ANT accounts for a combination of network relationships between heterogeneous actors which owe their position and power to the network of characters to which they are assembled and related to. The most profound resonance of ANT can be found within Science and Technology Studies [33-35], where it is frequently drawn upon as an interpretive lens to unpack the 'black box' by tracing the complex actor-networks and the heterogeneous actors translated and enrolled within them [36]. While space precludes a full account of ANT, we found it prudent to provide an overview of its main features and concepts such as actor, black box and translation before we start digging into a case analysis:

- Within the realm of ANT, **Actors** include both humans and non-human objects that interact with each other in network relationships [37]. This means that human and non-human actors should be given equal treatment and be described in the same terms in the ANT sense. The rationale for this is that differences between human and non-human actors are generated in the network of relations, and should not be presupposed. Also, in network relationships, an actor is not a single entity. An actor is also, always, a network [38]. Everything is at the same time both an actor and a network.
- The complex socio-technical relationships of various actor-networks constitute a black box. **Black box** was originally used in information science to examine the inner complexity of technologies in order to reduce complex technology to its inputs and outputs [39]. Taken up by ANT scholars the term is used to refer to the unquestioned acceptance of the technical as objective truth. Hence a black box is a technical artefact that appears self-evident and obvious to the observer. All technologies, from weaponry, to an iPhone, or in our case, a vinyl record, can be regarded as black boxes which are seldom questioned by users and commentators, at least for some time [40]. When an artefact is rendered black-boxed, the complex socio-technical relationships that constitute it are rendered invisible, no matter how controversial their history or how complex their inner workings [39]. On the contrary, when controversies around this artefact flare up, the process of black-box-building is ongoing. Opening the black box leads the way to an investigation of the way in which a variety of social aspects and technical elements are associated and come together as a durable whole. The relationships between the heterogeneous actors that come to stand behind a black box are never static and unchanging. As such, to identify a particular technology as being black-boxed is also to recognize the precariousness of this often times temporary situation [41]. In addition, there will always be dissenting or competing ideas and initiatives that seek to open black boxes that have been punctualized within larger actor-networks [33].
- **Translation** provides the conceptualization of what is actually occurring during the process of technical innovation. If there are countless entities and meanings built into a black box, translation is

the process by which these elements are related in a sociotechnical network. That is to say, translation is a process of making connections, creating convergences and homologies by relating things that were previously different [42,43], drawing actors and networks into a dynamic alignment. To put it in simpler term, translation is all about homogenizing different actors' explicit interests [33]. To realize the translation process, there are five strategies that can be applied: (1) the easiest way to enrol allies is to let one to be enrolled by them. By pushing others' explicit interests the network-builder also furthers hers; (2) the second strategy requires the network-builder to shift other actors' interests and assemble them into pursuing hers interests; (3) since the second strategy is practically rarely implementable, the third strategy suggests the network-builder offer a detour to guide different actors through a short cut to fulfilling their interests, during which process the network-builder's interests can also be fulfilled; (4) different actors' interests would narrow the network-builder's freedom for negotiation; the fourth strategy suggests that the network-builder reshuffle interests and goals either by displacing goals, or by inventing new interest groups; (5) in the fifth strategy, the network-builder has been black-boxed and become indispensable. From this point on, no further translation effort is needed; all the other actors, in order to further their interest, have to pass through the network-builder's position [33].

- A particular interpretation of translation is delegation. **Delegation** describes the reciprocal relationship between the social and the technical. It is a particular instance of translation whereby the social and the technical co-constitute each other; to read the social from the technical is similarly to read the technical from the social [36]. In any situation in which technology is used, it is used to delegate a major effort into a minor one. Human actors delegate to technologies (non-human actors) many of their work. In turn, non-human actors delegate behaviour back onto the social. Technology cannot be presupposed as an autonomous existence that exists outside of the social world. Within it contains a variety of political, social and economic elements as well as science, engineering and the particular histories of these practices.



In the context of innovation adoption and diffusion, ANT holds the claim that the authorship of the circulation of a technology rarely lies with individual geniuses or heroic entrepreneurs; and is instead attributed to a complex array of human and non-human actors that need to be considered as heterogeneous configurations [44]. The fate of facts and machines is in later users' hands; their qualities are thus a consequence, not a cause, of a collective action. According to Latour [33], this is the first principle in the making of technoscience. In light of this assumption, adoption and diffusion of innovation thus requires work and energy provided by a mass number of other actors. It draws attention to the fact that, in order to circulate and to succeed, innovative practices and artefacts' need to be different things for different people [45]. Consequently, the diffusion process is necessarily a transformation process: to diffuse and to transfer is to transform. A number of studies have summarized the process of innovation diffusion into a loose three-step sequence [46,47]. First, an innovative idea or technical artefact must be materialized into a tangible form, such as a text, a representation or a prototype (in our case study, music contents are embedded in a vinyl record); second, the object with meaning contained within travels through time and space until it is re-translated in some other locale in view of the new contextual conditions and existing practices; finally, the idea is institutionalized and taken for granted; and its origins carefully concealed from view. To spread a claim or artefact is a collective process; and the fate of its diffusion is in a large degree in later users' hands [33]. From this perspective, the process of translating an innovation requires interactions and the formation of alliances across space and time [45,48]. Accordingly, the power of dissemination or diffusion does not come from the network-builder alone; the momentum should come from a mass number of other actors [47]. Each of these other actors may react to the innovation in different ways. They may accept it, modify it, dissent it, or worse, ignore it. It is necessary to control others' behaviour and keep them in line, so that all forces can act as one towards the common goal of building a black box [33]. It follows that translation processes are always anchored in contexts: the new ideas have to resonate with multiple interests in order to be taken up, and the way in which they will be attributed meaning will be heavily dependent on the existing

conditions [33]. Another thing worth noting is that there will always be other competing innovations in circulation at any point in time. Only those that can gather the most allies and keep them in line win the race [29,49].

### **The case of vinyl- the re-incarnation trajectory**

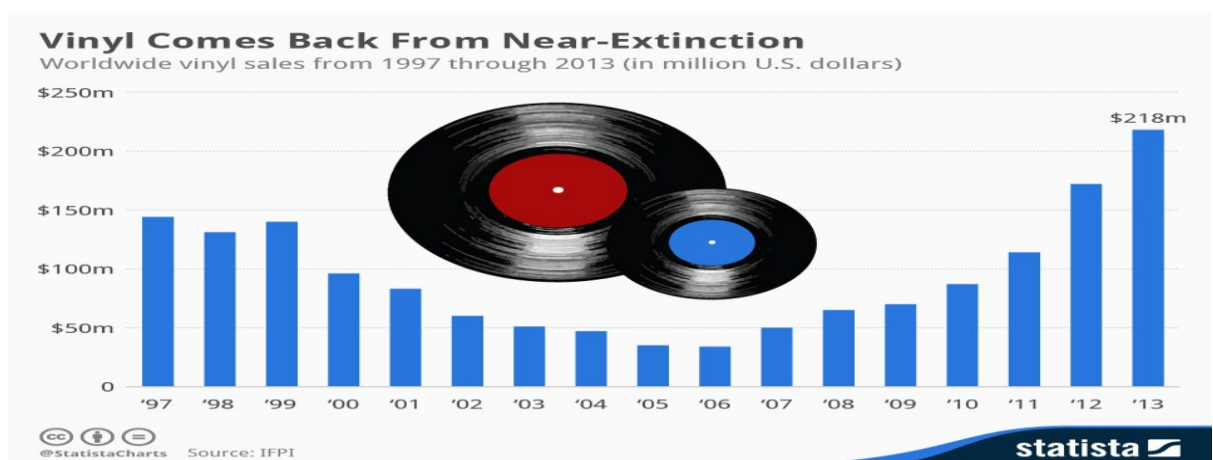
Recorded music (and other performances) in various formats had already existed for more than 50 years before the introduction by Columbia of the vinyl 33rpm LP in 1948. RCA's Victor had already released a vinyl LP, but it was not a commercial success because the playback equipment was too expensive [50]. The Colombian LP, as a combinative innovation, combined a 33rpm playback format with developments in production material that already existed [51]. The development and diffusion of the LP was consequently influenced both by the format, that allowed longer recordings, and the material, that was lighter, less likely to break, and generated less background noise [51,52]. This was considered a major technological breakthrough in the history of recorded music [53]. Soon after the technology was commercialized, it had been adopted as the standard by the entire music industry, and had remained so for several decades. With vinyl technology, music was no longer time and space-sensitive: music could be heard whenever people wanted to; music from remote areas could be uprooted from their places of origin and exerted huge impact in a local context. During 1948 to the 1970s, vinyl had reached the height of its popularity [5,53]. However, vinyl record was not without its own technical limitations. It was extremely vulnerable to scratches. Another technical drawback constraining vinyl was immobility due to its large size and heavy weight [3,5,8]. As the pattern of industry evolution suggests, old technologies will inevitably be squeezed out by newer ones. Vinyl did not seem to be an exception to this rule.

The year 1983 marked another turning point in the history of vinyl with Compact Disc (CD) arriving in the music market. The technological superiority of CD had been praised since its initial introduction into the consumer market. The unprecedented audio clarity, disc durability and storage capacity made CD a more attractive format than any other of its predecessors [4,5]. Since the 1980s,

CD diffused at an amazing speed, toppling vinyl from the throne in the kingdom of music [54]. The year 1988 marked a turning point for vinyl woo, for CD sales surpassed vinyl revenues for the first time [5]. Vinyl record sales declined 33% by a substantial 15% drop in market share; whereas CD sales increased 31%. Between 1978 and 1988, the number of vinyl units shipped by manufacturers dropped nearly 80% from 341 million to 72 million, according to figures released by Recording Industry Association of America [5]. Contrastingly, the number of CDs shipped went from nothing in 1978 to a shocking 149.7 million in 1988. From this point onward, vinyl seemed to find itself taking a backseat to the newly-arrived mainstream music medium. During the 1980s, vinyl inventories at major chains and malls diminished. CD outnumbered vinyl in stores by as much as 6 to 1. A large number of new releases were only available on CD. The unsold vinyl records were tossed aside to the back of stores or handled by special order [5]. Considering the scenarios, pundits had spelled the end of vinyl record. However recent statistics tells otherwise.

Facing a digital competitor, the profits for physical album have shrunk sharply during recent years, with CD sales falling by 19.6% [55]. Yet the linear movement is contradicted by a recent vinyl revival. A number of recent news reports show clear evidence of a significant uptick in the sales of vinyl, to everyone’s surprise [56,57]. As shown in figure 1, while vinyl sales as a percentage of overall music sales around the globe remain small; there has been a massive resurgence in vinyl sales.

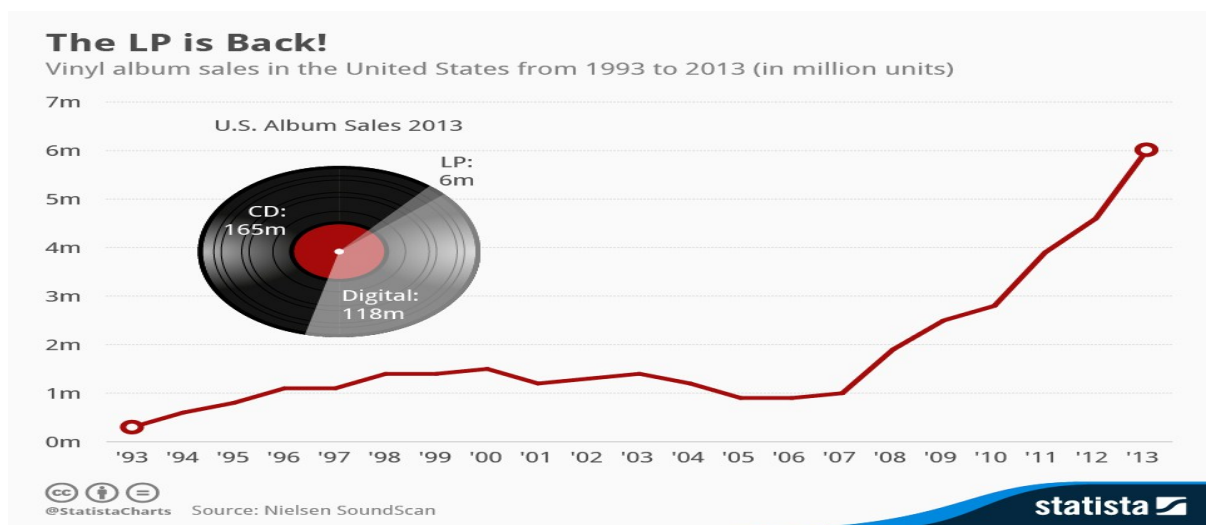
**Figure 1: Outlook of the vinyl revival**



Source: Statista [40]

According to the British Phonographic Industry, vinyl sales in the United Kingdom's are at their highest level for 15 years [58]. Over 780,000 vinyl albums were sold in 2013, a 101% rise compared to figure in the previous year [59]. As shown in figure 2, this upward trend is not just a UK phenomenon, vinyl sales has also hit a peak in the United States.

**Figure 2: LP/ vinyl album sales in the United States from 1993 to 2013 (in million units)**



Source: Statista [40]

The numbers from Soundscan mid-year report shows that the United States were up more than 40% in the first six months of 2014, with 4 million units sold [60]. In 2013, vinyl sales hit their highest level since at least 1991, with 6 million units sold. At the current pace, sales in the second half of 2014 seem highly likely to surpass that figure from the first half of the year. Such mind-blowing figures call for a rational explanation. Many have started to wonder: why the once made-obsolete technology is still preferred by music listeners today?

### The riddle of vinyl revival

In recent times, our understanding of the music enthusiasts' return to vinyl has therefore been extended as a result of some interesting lines of inquiry, analyzing the larger social, historical and intellectual context within which vinyl has emerged as a preferred music format [5, 7]. Plasketes [5]

has provided some interesting insight into vinyl's re-diffusion from a socio-cultural perspective. He argues that technological advancements are characterized by a cause and effect processes in which one form of culture gains importance where as others diminish. The obsolete culture icons can often result in the emergence of a subculture, made up of die-hard enthusiasts who, for various reasons, resist technology or progress and determinedly cling to the outdated artefacts because of the meaning and experience contained within. In light of this, the vinyl and its phase-out signal a cultural moment that is marked by the redefining of a product and the formation of a subculture of collectors. The significance of the vinyl record extends beyond a mere musical medium that stores sound information; it is "biography, history, culture and subculture" ([5], p.121). Like other artefacts of an age, vinyl record contains meaning derived from human experience, embracing emotion, passion and romance. It is because the connotative meanings that it carries that keep the old technology from total demise. Following up on Plasketes's study, Connolly [61] identified eight groups of listeners that still purchase, collect, listen to and preserve vinyl record. This empirical illustration has substantiated the subculture theory and enriched the existing knowledge. These eight groups of listeners consist of both amateurs and professionals. They are the nostalgic collectors; the new buyers; the label bosses; the young enthusiasts; the romantic musicians; the digger-turned-DJs; the digger-turned-dealers; and the Sighing Skeptics. These diverse groups of die-hard enthusiasts constitute and represent the vinyl subculture that keeps the format alive [61].

### **The momentum behind vinyl re-diffusion**

So what is the momentum behind this vinyl sales surge? Before we attempt to delineate the momentum behind the recent vinyl re-diffusion, it is worth reviewing how it all probably began, and possibly investigate why this old technology got diffused in the first place.

#### *Aligning a landscape of interests*

The diffusion and institutionalization of vinyl involved a fortuitous translation process of recruiting allies, aligning interests and establishing networks. First of all, we should consider that at

the time when the vinyl record was invented, recorded music was not the normative way of music-listening practice as it is today [53]. Live music performance at concert halls and other musical venues still constituted larger revenues in the music industry. Thus vinyl, the powerless new object and friendless network-builder, was eager to recruit allies and establish a powerful network of its own. The first actor it succeeded in translating was its inventor, the Columbia Records, who was trying to maximize business profits by promoting and selling as many copies of vinyl as it possibly could [5]. In this instance, not only did vinyl translate Columbia Records, but it also recruited a spokesperson for the network. Columbia Records spoke for the association's common interests, encouraging music artists to record their music specifically for vinyl. Out of fear of being phased out, other record companies followed suit and did the same, such as RCA and EMI. As record companies flourished, music artists were translated too. More music artists took to the idea, and they began to reach out for this new format [5]. They welcomed the extra income from the sale of vinyl albums beyond what they earned from live performances. With the increasing circulation of vinyl, new forms of composing pattern had to be created to fit the new format. Music artists were expected to create and perform differently to adapt to the new technology. They wanted their music heard by a large number of audiences; and this interest could be only fulfilled by taking this necessary detour. After some musicians succeeded with the new technology, more followed and accommodated more production of the same. Distributors capitalized on the business opportunities and also joined the wave. Soon, allies increased and the vinyl network started to grow stronger. When more and more music was released in vinyl format, consumers were seduced and drawn to join the increasingly powerful network. To help the vinyl spread momentum, another powerful ally, the radio stations, was also brought in. Local radio shows resorted to playing recorded music on air to attract a wider listener base. In so doing they also pushed recorded music to be heard across time and place. An audience who heard and appreciated a song on the radio would be likely to purchase a vinyl of that song and hear it again. After a while, the vinyl was taken for granted and rendered black-boxed. Drawing on the work of Walsham [62], table 1 is a description of the vinyl conceptual tools delineating the vinyl

landscape of interest.

**Table 1 Description of vinyl conceptual tools**

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Actor (or actant)	<i>The human and non-human actors'</i> : This includes vinyl record enthusiasts, recording industry associations, record shops, online-distributors, turn tables, vinyl record collectors, music engineers, record labels, vinyl specialty stores
Actor network	<i>Heterogeneous network of actors with an aligned interest</i> : These networks includes on-line vinyl fan groups, vinyl manufacturers and recording industry associations who record vinyl albums,
Enrolment and translation	<i>Creating a body of allies, human and non-human, through a process of translating their interest to be aligned with the actor network</i> : Annual record store day which gives form to the existence of a vinyl subculture
Delegates and inscription	<i>Actors who 'stand in and speak for' particular viewpoints that has been inscribed in them</i> including for example: Vinyl junkies, bloggers who evangelise about the pride of having and playing vinyl records
Irreversibility	<i>The degree to which it is impossible to go back to a point where alternative possibilities exist</i> : Reminiscence, nostalgic longing for elusive vinyl recordings, melancholy provoked by the appeal of colourful LP jackets,
Black box	<i>A frozen network element, often with properties of irreversibility</i> Vinyl LPs on which vinyl as a music format was developed, distributed, and consumed.
Immutable mobile	<i>Network element with strong element of irreversibility, and effects transcend time and space</i>

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### ***Old divided and new united***

Three lessons can be learnt from the vinyl diffusion process. Firstly, diffusion is only possible through a collective effort of many actors. Instead of possessing a vis inertia, the fate of vinyl was in fact in the hands of many other actors. It would go nowhere without the masses of allies arrayed in tiers that helped it spread in time and space. Secondly, adoption and diffusion requires immutable mobiles. Vinyl is an actor, and at the same time, a network of itself. The inner-making of the vinyl technology provided it the *immutable mobiles* [33] to spread across time and space. Thirdly, adoption

and diffusion requires the construction of a machine. Acting as the network-builder, vinyl succeeded in translating the juxtaposed set of allies into a machine. Within the machine configuration, actors were assigned roles so that they could act as one, pursuing the common goal of spreading and diffusing vinyl and rendering it black-boxed. As a result, the borrowed forces kept each other in check and none could break apart from the network. Unfortunately, the strongest association is only as strong as its weakest link [33]. No matter how large a crowd the vinyl had succeeded in assembling, how powerful some forces within the association might be, all the knitting and tying them together can be undone. Allies can be made to betray, even the most faithful of them. Technological advancements are always characterized by a cause and effect process: a simultaneous evolution of one form and de-evolution of another [5]. CD, a newer object, was more attractive than vinyl. CD was at the same time an actor and a network of itself. A large number of components and elements went into the construction of a single digital disc. Compared to vinyl, CD was more sophisticated; more transportable; less vulnerable; and highly fashionable. It had achieved a reversal in the trials of strength by cutting the links that tied them to vinyl. From this point onward, record companies started to promote CD and deleted their vinyl catalogs because this was more profitable; music artists released their latest hits only on CD because they saw where the record companies were going; radio stations broadcast music on CD instead of the vinyl because the former was widely available; distributors removed unsold vinyl records from their shelves and replaced them with CDs; consumers started purchasing CD because vinyl inventories at major chains diminished. Forces that used to stand behind vinyl were now lured away from their representative. This marked the disassociation of an old network and the establishment of a new.

### *New source of energy*

The vinyl network divided, but it did not disappear. As we know, vinyl is still there, active, constantly being purchased, sold, listened to and passed along within a small network. To be precise, the vinyl network did not divide; it just shrank to a much smaller size with less power. As Plasketes



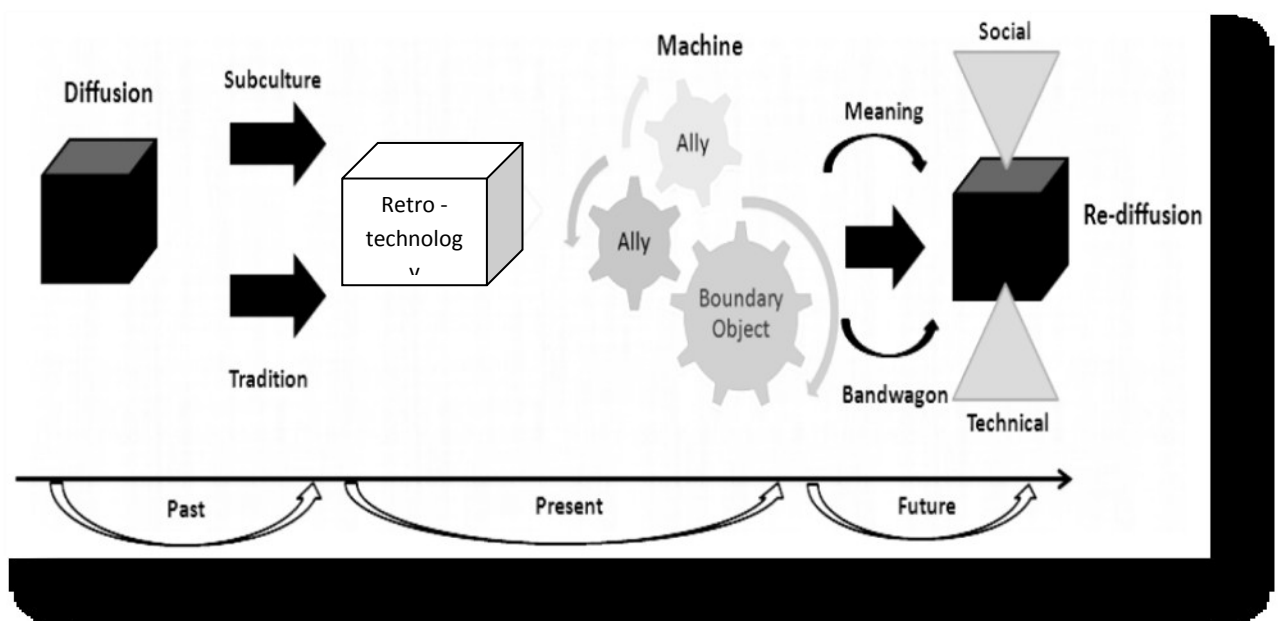
[5] points out, the passage of cultural icons and their accompanying artefacts can often result in the emergence of a subculture, made up of those who resist technological progress and determinedly cling to the old artefact for its special meanings and experience. For vinyl, powerful forces changed camp, yet some allies did stay and the network was transformed into subculture. These loyal allies are mainly constituted by the eight groups of die-hard music enthusiasts identified by Connolly [61]. Although these forces combined were still far from enough to help the vinyl re-diffuse in time and space, they did keep the network from complete demise. The other forces that helped construct vinyl's past glory do not disappear either, with their interests stay more or less unchanged: record companies and distributors are looking for ways to maximize their earnings; music artists want their music heard by as many as possible; consumers are longing for greater music-listening experience at a lower price. All these interests are currently aligned to the internet-based music streaming service, providing digital music with strong momentum to remain the obligatory point of passage. However, these forces betrayed once, they can betray again. Their interests can be translated when their interests are reshuffled. The meanings of the interests of consumers, of music artists, and of record companies and distributors, can be interpreted in a different way. Consumers want a good music-listening experience at an affordable price. This can be interpreted as they want music with better sound quality and authenticity. After all, digital music fools the ear into believing that it sounds better though it is actually less rich sounding than vinyl [53]. Consumers may settle for MP3 for a while, but not forever. Music artists want their music heard by a wider audience. This goal can be better achieved if they release their latest hits on both digital and physical formats. Music distributors can put vinyl for sale online alongside their streaming services to increase sales. In terms of record companies, they must be thrilled at the idea that the vinyl is coming back, considering their shrinking businesses. Translation process proceeds along uninterrupted chains [38]. In order to move in time and space, a new source of energy that can connect this long chain of association is needed. This new source of energy is crucial, providing the ultimate source of strength to tip the balance of force in its favour. This new source of energy is the internet. Thanks to the internet, acting as a boundary object,

now all the interests can be aligned. Consumers can enjoy music with better quality and authenticity because vinyl albums are also available for sale online. Some consumers may decide to purchase a vinyl record after they have heard the digital version of a song that they like. Especially, social media also drives consumers to the local record shops to thumb through vinyl records. This resonates with Magaudda's [7] observation that physical artefacts occupy an increasingly important position in the wave of digitization. Die-hard vinyl fans also take advantage of the internet to maintain their subculture network, in the name of preserving and re-distributing their beloved vinyl. Music artists can record their music in both vinyl and digital formats at one recording. This is made possible by the latest music recording software. In fact, some musicians gain a wider audience after they decided to go both digital and analogical [53]. Since demands for vinyl are on the rise, distributors put vinyl on their online shelves, along with digital products, for sale. Record companies have also been pressing vinyl records as online orders keep coming in. By adding the internet to the list of its allies, vinyl modifies the relations of heterogeneous forces. Where it was weak in portability, it is now stronger than anyone else. The paradox is, the more the disruptive innovations like the internet boost the overall productivity of the economy, the more room there will be for old-fashioned industries that focus on quality rather than quantity and heritage rather than novelty. Being praised for its quality and authenticity, the vinyl is again coming up to the music arena.

### **Immortality or a re-incarnation by translation**

Moving through a series of translations, various interests are re-aligned thanks to a new source of energy. Yet the internet is so powerful itself that a new and deeper problem floats to the surface: can the internet, brought in to keep the groups of forces in line, be kept in line? The newly-emergent vinyl network is a shifting and unstable alliance. Can it be turned into a tightly-glued whole that can link all the elements together durably? After all, if the boundary object betrays, the whole enterprise breaks down and vinyl will shrink back to a single time and a single place. Then, what is the *perpetuum mobile* mechanism that sustains the new vinyl network?

Figure 3: The adoption and re-diffusion of a retro-technology



### *Rebuilding a Sophisticated Machine*

The simplest means of transforming the juxtaposed set of allies into a whole that acts as one is to tie the assembled forces to one another into a machine, where borrowed forces keep one another in check so that none can fly apart from the group [33]. Magaudda [7] has already provided a sophisticated system of machine with his “circuit of practice”. Within this machination, complicated negotiations occur constantly: the wide spread of digital music and online streaming services have devalued the authenticity of music-listening experience; the devaluation prompts consumers towards the adoption of a more material form of music format, which is the vinyl; the vinyl re-configures consumers situated practices which in turn changes the meaning of the value of materiality; as the format increases in value, music artists join the rising trend; as a result, distributors and record companies follow suit, leading to the circulation of vinyl records online alongside digital streaming services; finally the re-incarnation of vinyl records forms the basis for buying, listening, conservation and appreciation of vinyl records. The re-diffusion machine forms a process of reconfiguration of meanings, values and feelings around the use of vinyl. Vinyl capitalizes on this complicated machination that makes each force interested in the working of the others. Assembled forces within

the machine are closely interlinked and rendered the roles of inspectors to check on one another. As a result, the assembly of disorderly and unreliable forces has turned into a stronghold.

### *New Meanings Embedded in Materiality*

Music in its material form is playing an even more essential role in music consumption practice today. Going by this assumption means that having some dominant physical form is a hugely promising advantage in contemporary music landscape [7]. The physical album represents what music really is. The materiality of vinyl makes it visible as a social object. Elsewhere, Law [38] argued that materials are more durable and can maintain their relational patterns of longer. In this regard, music can be safely regarded as a social product rather than something generated through the operation of a privileged musical method. Social product should take on a material form to be visible to other social actors [37]. Music comes as live performances or recorded albums; it appears live in concert halls or sitting in store shelves; it appears in the form of musical skills embodied in music artists. Thus, music is always embodied in a variety of material forms. The material itself has changed following the translations. As more people are made to be interested in vinyl, this increasing number of stakeholders has to be obtained through a deep transformation of the design and principles of the vinyl technology. The vinyl we play today is not the same vinyl as it was decades ago. It has been transformed so much during series of translations. Since its introduction in 1948, countless refinements and developments within the industry have been made to perfect its technical excellence and insure the best in sound reproduction and quality available in recorded form [63]. The meanings contained within have also been modified dramatically. Vinyl is not simply a recording format, but the artifact of an age; it is an experience that embraces emotion, passion and romance [5]. In fact, this technology now possesses multiple meanings, and can be interpreted differently by different groups of consumers. It is because of the different meanings and experience, the investment of passion, emotion and romance that makes the vinyl network flexible and durable. Different sets of relations and meanings are embedded in a durable material and a relatively stable network is maintained.

### *Emergence of a bandwagon*

As argued by Fujimura [64], an idea or practice becomes the object of imitation if it is taken up by an overwhelming number of other actors. Often, the more a technology is adopted, the more they will be adopted due to network externalities [10,46,65]. When vinyl first got diffused, it was considered the obligatory point of passage for everyone in the field of music. As more people came to believe in the vinyl, others also hopped on the *bandwagon* regardless of the underlying rationale. They bought it, listened to it and passed it along without any dissent. Soon enough, vinyl became a routine black box in everyone's hands; in turn, everyone contributed to the spread of it in time and space. It does not have to cater to others' interests, not to convince them or reshuffle their original goals. Apparently, the diffusion of a technical artefact, from some point on, depends on the generation of a robust bandwagon [47]. In the case of vinyl's recent re-diffusion, the creation of a bandwagon depends largely on the circulation of a suitable intermediary - the internet, that enrolls powerful allies and helps build a network of inter-dependent relationships. The emergence of the internet has come to provide space for vinyl enthusiasts to cluster. Acting as an intermediary to linking enthusiasts across time and space, it provides space for actors to enter into proximity with one another. Anybody sharing the same feel and sentiment about the demise of the technology can join the evolving differentiated network. It also acts as a platform making the transaction and preservation of vinyl records possible. As a complex technology that provides plethora of possibilities for interaction, the internet displays endless increasing returns to adoption and network externalities. In addition to intermediary, the creation of a bandwagon also requires a complicated process of negotiation, by which everyone can find a seat in the moving bandwagon. In this sense, a machine is a must where all allies act as an organized whole. Within the machine, all elements are designated specific roles to play and negotiations go on constantly to keep each other in check. These have led to the emergence of a bandwagon for vinyl re-diffusion.

### *Connecting the technical and the social*

Technological artefacts are both socially constructed and society shaping [10]; they are developed and implemented by social actors or groups of actors and that their final forms are the product of a complex social process of interaction of these actors and groups [66]. In this sense, vinyl is at the same time both a technical and a social artefact. Consumers may question the technicality of vinyl, because for most of them most of the time, a vinyl record is a single and coherent object with relatively few apparent parts. Much of the time they are not in a position to detect the technical complexity of a vinyl record, despite that its inner-working is no less sophisticated than any other state-of-the-art technologies. Vinyl has been viewed as an everyday technology, for which reason the technical networks which go into the making of a single vinyl record come to be invisible, concealed from view by its apparent unity. Consumers start to take notice of the complicated inner-working that lies behind and make up a single vinyl record only when a technical problem occurs. When a vinyl record breaks down, stops functioning, it rapidly reveals the technical aspect of itself as a complicated network of components and human interventions [33].

Following the translation processes, we have learned that enhanced functionality plus new meanings made vinyl possible to re-interest many other actors in its re-diffusion in millions of copies. This implies the important role society plays in the vinyl re-diffusion process. Vinyl could spread in time and space because there is an extension of complicated commercial networks stand behind it: from record companies and distributors, to music artists and to the end users. When a consumer places a vinyl record down on a turntable, activates the tone-arm then sets the stylus, the music starts. However, this consumer does not see the music artists composing and recording the music; he/she does not see distributors selling or record companies pressing or the machine operator producing the vinyl record. End users do not see all these other actors, but these actors have to be there in place. If they are not, then when the vinyl record is put down on a turntable and the stylus set, nothing happens. Even if vinyl had become a routine piece of music equipment, it still requires an active network of social actors if it is to be maintained in existence. Hence, the vinyl story may be analyzed in two different directions: either by looking at its technicality tied to actors that come from

heterogeneous social networks; or by looking at the various social actors drawn to stand behind its technicality. Vinyl is in between these two realms of alliances. It connects the two realms together and that, when it is successful, it concentrates in itself the largest number of hardest associations.

## **Discussion and conclusion**

In this study we have applied the toolbox of ANT to the field of retro-technologies. By examining the case of vinyl, we attempted to interpret and analyze the momentum behind its recent resurgence and re-diffusion. In doing this, we followed the “actions” of a non-human actor - vinyl, acknowledging its role as the network-builder. Thus, we focussed on understanding the generation processes that stabilize networks and their irreversibility rather than existing human-centred approaches to studying innovations [45], which implicitly assume that ‘society is the medium through which innovations diffuse more successfully’ ([30] p.526). If we had started our analysis from human actors, our study would inherently obscure the role of non-human actors in the translation processes. On the contrary, we follow Callon [67] to argue that much is to be gained if we focus on non-human actors rather than their human counterparts. In this regard, we made the conscious effort not attribute agency or authorship before we started to investigate the resurgence of vinyl in our digitalized age. The possibility should always remain open that the source of some events and activity is actually non-human actors. In our case, the diffusion and re-diffusion process of the vinyl depended just as much on the work performed by non-human actors as it did on the work of the human actors.

Our study suggests that the re-diffusion process required a collective effort. Re-diffusion calls for the recruitment of a mass number of allies and the alignment of their interests. This effect can only be achieved through a series of translations. Translation would not be successful without the help of a new source of energy that serves as the boundary object. The boundary object stages and frames the juxtaposition of allies into a tier of stronghold that would not break apart. The assembled forces within a machine configuration are made responsible for one another so that the stronghold would not be penetrated. The network builder is at the same time a technical and a social object. As such, the

case of vinyl not only proved that ANT as a meta-theoretical lens is especially suitable for interpretative analysis of retro-technologies re-diffusion, but also provides a promising approach of analyzing and narrating the re-diffusion process as a contingent and uncertain power struggles through which translation of interests and negotiation of power are constantly occurring. ANT indeed helps bring fully to the fore the networked and interest-led nature of the re-diffusion process.

The story of vinyl as unpacked in this paper is only a tip of the iceberg in the huge wave of recent retro revival. The merest glance across today's market reveals that products and services based on retro concepts are all around. For whatever reasons, the fact is this retro-technology is making a comeback. In Carlin's ([68], p.110) words: "Contemporary consumer culture is beset by 'yestermania', an inordinate fondness for revivals, re-enactments, remakes, reruns, and re-creations." In addition to vinyl, a large number of other retro-technologies have also been tactfully reanimated and successfully re-launched in recent years, such as mechanic watch and fountain pen [69], to name a few. We believe that there are some general knowledge that can be captured to illustrate the essence of the adoption and re-diffusion of these retro-technologies. From the case analysis, we have learned that for a near-obsolete technology to revive and re-diffuse, two preconditions have to be met. One is that the technology must once be the obligatory point of passage in the past; a vital essence during a specific developmental stage for a particular generation of cohort [23]. The other is, that the technology must be able to remain in existence through maintaining at least one group of loyal allies within the network it has built; this group of allies represents the subculture made up of die-hard enthusiasts that are reminiscent and traditionally-minded; they insist on preserving and re-diffusing their beloved artefacts. When and only when these two preconditions are met, can a near-obsolete technology be qualified for re-diffusion. It is worth noting that the process for re-diffusion involves a series of translations and complicated negotiations.

First, a new source of energy, a boundary object that helps align different interests and gather all the allies are essential, as it provides the ultimate source of strength to break the status quo and tip the balance of force. After this new energy is obtained, a sophisticated machine has to be built in



order to transform the juxtaposed set of allies into an organized whole. The machine makes sure that borrowed forces can keep each other in check so that none would break off. During the process of translation and machine-building, the physical design and inherent principle of the technology would inevitably be transformed. Thus the technology must be flexible and amenable to both technological and symbolic updates so as to ensure its perpetual relevance in the modern context [23]. The updates will consequently bring more and more audiences to the technology, creating a bandwagon effect. At the final phase, the technology must stage and frame the bits and pieces so that the social and the technical can be delegated. Then finally the making of a black box is complete.

In a nutshell, the re-diffusion process is a long and complicated one, in which allies are recruited, interests are aligned, roles are designated and networks are sustained. Our proposed conceptual model of the re-diffusion of retro-technologies, we believe, has not only portrayed the re-diffusion process, but also captured the essential characteristics that qualify a retro-technology for re-diffusion in the modern context. On a theoretical level, our study shows that the conceptual vocabulary of the sociology of translation can provide an alternative interpretive lens to evaluate the configuration of heterogeneous actors in the transformation of the contingent and contextual meaning of innovation. While previous studies on retro-technologies takes on marketing, organizational or industry perspective, we propose a new perspective of understanding retro-technologies, the society and relations among them. Not all, our study also differs from prior studies that examined retro-technologies using the S-curve as a point of departure; we break loose the constraints of the linear approach and substantiate the view that “looking backward also provides valuable insights”.

Our study also holds some implications and significance for practicing managers. First, while retro-technologies, especially in the case of vinyl, may not have the potential to fully disrupt current and emerging technological trajectories, managerial understanding of the momentum behind the revival of old technologies may lighten their imaginations to identify potentialities and possibilities for extracting value from their once prized technologies that have long been cannibalized or disrupted by new technologies. Such was the case of Retro Computers Ltd when they decided to

bring back the popular 1980s ZX Spectrum computer [72] by creating something special that resonates with those who grew up with the original Sinclair Spectrum, as well as being accessible to today's gamers looking for some nostalgic game play while having the ease of use of modern technology at a very low price. A successful crowdfunding campaign backed by ZX Spectrum inventor Sir Clive Sinclair raised £149,521, which is 50% more than the company's target [71,72].

Second, Old technologies, we observe, just like brands belong to and can be co-reincarnated with groups of communities [23]. From an ANT perspective, these communities exist in local, technological mediated arenas and contested cultural and peripheral spaces. This calls for technology managers to develop strategies to map out, locate relevant gatherings of these groups, and engage them in ways that provide insights into emerging consumption patterns. Furthermore, our study and its managerial significance complements the increasingly accepted view that cultivating sensitivity to emergent events occurring beyond prevailing socio-technical regimes [72, 73], could lead to the identification of opportunities, potentialities, and limits of technological transitions and innovations in emerging niches [74,75]. Obviously, our study is not without limitations, which in turn open up opportunities for further research on the diffusion of retro technologies. First, our focus on one type of retro-technology, vinyl, has all the limits of a single case study [76]; in this regard, care should be taken in generalizing and interpreting our analysis and theoretical leaps in the context of other technologies. Analogous studies with respect to other retro-technologies may be necessary to ascertain whether additional insights and findings can be observed or generated. We encourage such studies to strive also to account for the potential of the retro-technology to disrupt current and technological trajectories. Second, the conceptual model we developed in this paper is not anchored in data. We have embarked on what can be described as a quasi-speculative expedition to specify the organizing logics of the adoption and re-diffusion of vinyl technology. This calls for both exploratory and confirmatory studies to test the applicability our model. Third, our conceptual model also highlights potential opportunities for further theoretical and empirical inquiry into the possibility of a retro-technology to penetrating other niches and, in particular, how it may precipitate a process of 'creative

destruction', disrupt, and out-compete current technologies [77]. While further theoretical work may be needed to 'tighten' the framework, future research could go further to explicate and investigate prevailing organizing practices, interactions and relationships of actors that may facilitate (or constrain) retro-technologies from diffusing beyond traditional niches.

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