



CHAPTER FIVE

REPURPOSING: A COLLABORATIVE INNOVATION STRATEGY FOR THE DIGITAL AGE

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5.1 Introduction

Most academics and practitioners associate the term innovation with the creation of something new, and our general mindset is shaped by innovations that are new to the world and have a large impact across economies and societies. Less emphasis has been placed on managing innovation and new product development that is based on new applications of existing solutions, although the innovative potential of recombining existing knowledge and technologies was acknowledged early on in the innovation literature (Mastrogiorgio and Gilsing 2016; Nelson and Winter 1982). Academics and practitioners are starting to show renewed interest in the potential of reusing existing solutions to address unsolved problems and needs (Langedijk et al. 2015). The practice of transferring a known solution to a new context is called “repurposing” and represents an often untapped opportunity for companies to innovate at low cost (Allarakhia 2013).

When thinking about repurposing as an innovation strategy, the example of Sildenafil, better known as Viagra, quickly comes to mind. Pfizer’s well-known drug was initially developed as a treatment for angina pectoris (chest pain). An unexpected side effect led to its very successful commercial repurposing into a drug for the treatment of erectile dysfunction (Pushpakom et al. 2019). This is just one example of successful repurposing. In fact, repurposing is one of the key innovation strategies in the biopharmaceutical industry, with up to 30% of drugs approved by

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the United States Food and Drug Administration being the result of repurposing efforts (Kesselheim et al. 2015). The widespread recourse to repurposing was particularly evident during the COVID-19 pandemic, where 86% of drugs tested against the disease through July 2020 were repurposed drugs (Hanisch and Rake 2021).

While many examples of successful repurposing come from health care, the phenomenon is prevalent in many contexts and industries. A classic example is Richard T. James' 1946 invention of springs that supported and stabilized delicate instruments aboard ships in rough seas, which were repurposed as the wildly popular Slinky toy. A similar example is the creative arts and crafts toy Play-Doh, which was originally used as a wallpaper cleaner. More recently, during the COVID-19 pandemic, Epic Games repurposed the opportunities for interaction among the players of its game Fortnite to host a digital concert series. Other examples include the repurposing of electric vehicle batteries to power data centers, offices, and railroad crossing devices. The use of LIDAR, a laser-based technology for precise distance measurement in autonomous driving vehicles, is another example of repurposing, as this technology originated in the aerospace industry and was used on the Apollo 15 mission in 1971 to map the moon. In the IT and software industries, it is common to repurpose existing software codes for new applications. For instance, the image-sharing platform Flickr was largely built through repurposing code used for an instant messaging service within an online game.

As these examples demonstrate, repurposing occurs frequently across many industries and contexts, but there is a need for a more systematic discussion of what repurposing is and how companies can use repurposing as a product development strategy. To address this challenge, we first introduce repurposing as a viable innovation strategy (5.2) and discuss its building blocks (5.2.1), sources and applications (5.2.2), and links to the concept of open innovation (5.2.3). In the third section (5.3), we identify the strengths (5.3.1) and weaknesses (5.3.2) of repurposing as an innovation strategy. In our final section (5.4), we show how repurposing can be executed successfully through targeted search and rapid execution (5.4.1), and the use of digital technologies (5.4.2).

5.2 Repurposing as a Product Development Strategy

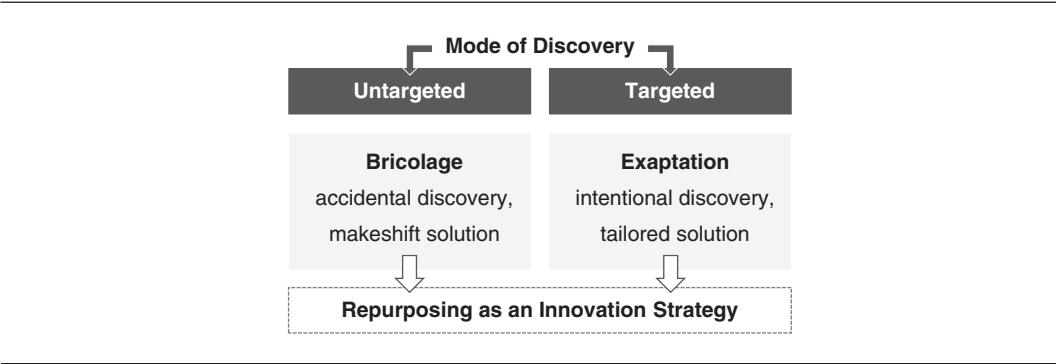
The innovation management literature indicates that repurposing is a frequent, yet often overlooked source of innovation. Most studies on repurposing associate the concept with drug development. Accordingly, Pushpakom et al. (2019) refer to repurposing as a strategy for “identifying new uses for approved or investigational drugs that are outside the scope of the original medical indication.” Beyond this contextualized definition, the innovation literature understands repurposing in a broader sense as the reuse of a product or its parts for a functionality that differs from the originally intended purpose (Garud et al. 2021). Based on this broader definition, the literature normally focuses on the repurposing of technological innovations or scientific discoveries that may serve a new market but go beyond mere market expansion, as serving a new functionality is a defining

feature of repurposing. As such, repurposing offers an alternative route to innovation in contrast to innovation processes characterized by “science push,” “demand pull,” or “institutional steering,” which are typically commenced and driven by the desire to realize a functionality that has been identified *ex ante* as desirable (Garud et al. 2018).

5.2.1 The Building Blocks of Repurposing: Bricolage and Exaptation

Repurposing consists of two core elements: bricolage and exaptation (Garud et al. 2021). Bricolage is the use of existing and available resources to address new problems or opportunities (Baker and Nelson 2005; Lévi-Strauss 1966). An example of bricolage is the development of a replacement CO₂ filter with resources available in the Apollo 13 capsule – including plastic bags and duct tape – by NASA engineers and the crew on board. While this example shows that bricolage can create an ad hoc solution that in this particular case helped prevent fatalities, it is clearly not a viable or reliable innovation strategy for spaceflight in general (Rönkkö et al. 2014). Instead, bricolage may offer a “quick fix” for a pressing need but the performance of such solutions is often limited. An alternative mode of discovery is exaptation, which refers to the institutionalized process by which a product, or a part of a product, developed for a specific purpose is coopted to serve a different purpose in a different area (Andriani and Carignani 2014). Exaptation describes the institutionalized and more deliberate process by which a solution to a problem emerges serendipitously from a known solution to another problem (Andriani and Kaminska 2021). The repurposing of the CD from a system for playing high-quality sound recordings to a tool for data storage during the 1980s and 1990s is a classic example of repurposing, which in this case required additional systematic and institutionalized processes, including the creation of industry standards. Figure 5.1 illustrates the logic of bricolage and exaptation as the main mechanisms behind repurposing.

FIGURE 5.1 THE PILLARS OF REPURPOSING.

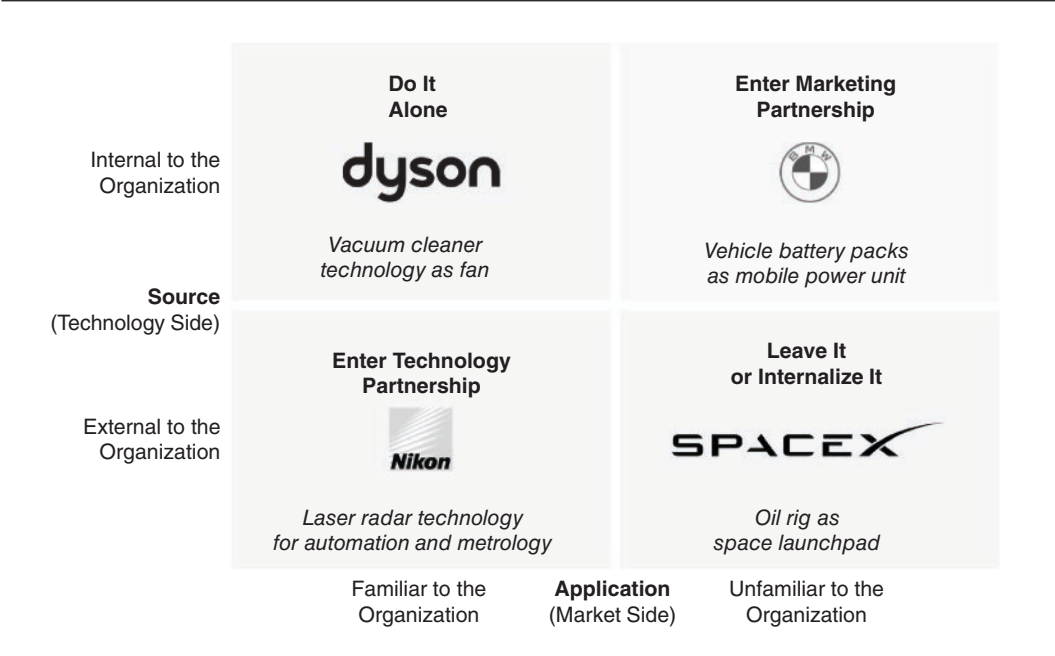


5.2.2 Sources and Applications of Repurposing

For organizations, an understanding of the sources and applications of technology repurposing is critical to its effective deployment as an innovation strategy. Figure 5.2 distinguishes repurposed innovations in terms of their source – internal or external to the focal organization – and their application, i.e., whether it is in a field familiar or unfamiliar to the focal organization. The repurposing of Dyson’s vacuum cleaner technology for other types of home appliances, such as bladeless fans and heaters (Vincent 2017), provides a good example of repurposing within the focal organization for applications with which it is familiar. In this case, Dyson had mastered the technological and market sides, and was thus well equipped to repurpose its product independently without the involvement of collaboration partners. The advantage of a “do-it-alone” strategy, in which one organization has mastered all the necessary skills and controls the process, is that it enables rapid execution in terms of technology development and marketing.

The origin of an innovation that is repurposed in a familiar area may also be outside the focal organization. In this scenario, the organization identifies a technology with which it has little or no experience but that can be used in a new area in which it already operates. Recently, the Japanese optics and imaging company Nikon entered a technology partnership with the American technology specialist Aeva “to repurpose FMCW [Frequency Modulated Continuous Wave] technology for industrial automation and metrology”

FIGURE 5.2 ORIGIN, APPLICATION, AND EXECUTION OF REPURPOSING.



(Nikon 2021). Nikon has long-standing experience in industrial automation and metrology and is working with Aeva to apply laser radar technology, used primarily in automotive navigation, to a new field. For Nikon, it is reasonable to partner with Aeva to gain access to technological know-how and to leverage its existing market access to effectively repurpose the technology. In general, such technology partnerships are often a viable option when the technology comes from an external source, but the market know-how resides in-house. Compared to “do-it-alone” strategies, technology partnerships create additional hurdles due to learning costs on both sides and the potential fear of knowledge misappropriation on the part of the technology provider, which can slow down development.

Similarly, companies can also seek new applications for their existing technologies outside their focal markets. The repurposing of electric vehicle batteries at the end of their life cycle into mobile power sources provides a good example of technology repurposing that originates within the focal organization and is applied to an unfamiliar domain. BMW engages in this type of repurposing through a marketing partnership with Off Grid Energy Ltd., a United Kingdom-based provider of electricity supply for construction sites, events, and for other users not connected to the grid (BMW Group 2020). A (marketing) partnership based on a long-term contract or even a joint venture is often an appropriate governance structure in cases where the focal organization has access to and expertise with a technology, while the partner has knowledge of the target market for the repurposed technology. In principle, the situation is similar to the first example of a technology partnership, with the difference that the agency for repurposing (i.e., who initiates the collaboration) in the first case lies with the marketer rather than the technology provider.

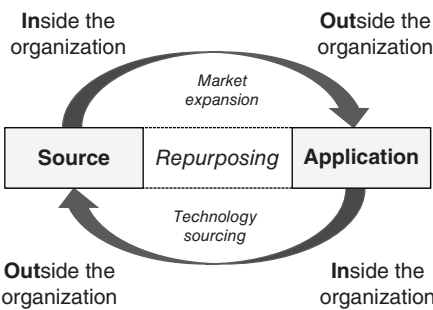
Finally, the impetus for technology repurposing may come from a technology external to the focal organization with applications that the focal organization is unfamiliar with. Sometimes an “outsider” view is necessary to recognize the repurposing potential of a technology in a new market. An example of this fourth type of repurposing is SpaceX’s investment in oil rigs originally designed for deep water drilling. SpaceX purchased decommissioned oil rigs in 2021 to repurpose them as floating spaceports for its Starship, a “fully reusable transportation system designed to carry crew and cargo for interplanetary flights” (SpaceX 2022). In this case, the technology was unfamiliar to SpaceX, recommissioning was carried out by a specialized service provider, and the application (floating spaceports for a novel rocket type) did not even exist when the project was launched. Given the dual risks that this type of repurposing entails, most organizations do not pursue this approach without a compelling strategic reason to develop the required competencies. If the repurposing opportunity is deemed worth pursuing, it often makes sense for a company to acquire the technology that they aim to repurpose to internalize the know-how and to collaborate with specialized service providers to realize the full potential.

5.2.3 Open Innovation and Repurposing: Collaborating for Success

Repurposing often requires cross-company collaboration to access existing technologies or markets outside the companies’ current scope of operations. The literature on open innovation has long emphasized the benefits of exploiting the potential for innovation outside the firm’s boundaries. This idea is equally significant for repurposing strategies. Open innovation describes the “use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation” (Chesbrough 2006). According to this definition, open innovation includes an inside-out and an outside-in perspective (see Figure 5.3). In the context of repurposing, the inside-out approach describes cases in which an internal technology is made available to another organization for a new application, e.g., through licensing or selling intellectual property. In this case, repurposed technology is applied to an expanded market. In contrast, the outside-in approach broadens and deepens a company’s internal knowledge base by integrating external knowledge for application in a new context. Hence, the repurposed technology comes from a source outside the focal organization.

The inside-out perspective of open innovation offers opportunities for companies to generate additional revenues by finding new applications for their existing product portfolio. Companies can act upon these opportunities by using different collaborative mechanisms of the open innovation toolbox, such as selling their intellectual property or licensing it, or by creating and supporting spinoff companies (Chesbrough 2012). Acting upon the opportunities provided through the application of an inside-out perspective benefits companies as they can bring their (repurposed) innovations to market more quickly by relying on a partner that has expertise in the target market. For example, when NASA developed special hydration solutions for its astronauts working in extreme conditions, it recognized that the beverage may appeal to a broader audience and licensed the technology to The Right Stuff, which now markets the product to high-performance athletes. Companies applying the inside-out perspective open up opportunities for generating additional revenues and profits that are not restricted to the markets that the company itself serves.

FIGURE 5.3 APPLYING PRINCIPLES OF OPEN INNOVATION TO REPURPOSING.



The outside-in perspective of open innovation allows companies to broaden and deepen their own knowledge spaces by integrating knowledge, competencies, or technologies that emerge outside the firm's boundaries. In the context of repurposing, the outside-in perspective of open innovation suggests that companies can expand their product portfolios by repurposing solutions that exist outside their domains, despite these solutions having been originally developed for a different context. In the 1950s, for example, French engineer Marc Grégoire and his wife Colette Grégoire recognized the potential of Teflon, a recently discovered nonsticky chemical material marketed by DuPont that was originally used as a coating for uranium-storing equipment in the production of nuclear bombs, as a potential coating for frying pans, which has since become a standard household product. With large portions of development already completed, sourcing technologies from outside a firm's boundaries and repurposing their application can provide significant benefits in terms of development costs and a shorter time to market. Furthermore, companies can build on the knowledge and developments made in industries other than their own. Because access to a solution that can be repurposed provides the originator with the benefits associated with the inside-out perspective of open innovation without increasing competition in the originator's core markets, repurposing offers great potential for mutually beneficial collaborative innovation.

5.3 Benefits and Challenges of Repurposing

5.3.1 Benefits

Cost efficiency. One of the main advantages of repurposing is its cost efficiency. As the underlying science and technology of a product that should be repurposed is already well understood and less additional testing is required compared to de novo developments, repurposing can lead to substantial cost savings and shortened development times (Breckenridge and Jacob 2019). This advantage is particularly evident with repurposed drugs that have usually proven their safety in the treatment of another disease. Despite the need to conduct additional clinical trials to demonstrate the efficacy of the drug in a new disease context, it is possible to significantly reduce development times and costs compared to new developments (Naylor et al. 2015). Estimations from the pharmaceutical industry suggest that repurposing may save up to 85% of the development costs and shorten the development cycle by up to 5 years (Paul et al. 2010). Given these financial benefits, repurposing offers an attractive opportunity to develop solutions for otherwise unserved niche markets, such as treatments for rare diseases, which are often unattractive for de novo developments due to their limited market size (Kucukkeles et al. 2019).¹ At the same time, the commercial success of repurposed innovations can be substantial and a highly attractive investment opportunity (Naylor et al. 2015). The long-term success of the antiseptic mouthwash Listerine illustrates the commercial potential of repurposed innovations. Originally developed as a surgical antiseptic in the late

19th century, it became a very profitable mouthwash during the 1920s. Today, it is still a leading brand across many markets, generating significant sales. Similarly, the annual sales of the drug Revlimid peaked at approximately USD 4.3 billion after being repurposed from an antinausea remedy to a multiple myeloma treatment (Naylor et al. 2015). Finally, repurposing is a valuable innovation strategy when external shocks or the emergence of a crisis require accelerated responsiveness with relatively low barriers to entry (Hanisch and Rake 2021; Liu et al. 2021).

Rapid execution. Another key advantage of repurposing is the rapid introduction of the repurposed innovation. In most cases, the product is already on the market, and the production facilities are in place, making it easier to launch and scale the product. Automaker Dodge, for example, repurposed the preinstalled ultrasonic parking sensors in its Dodge Charger Pursuit police cars to enhance officer safety. When the feature is turned on, the parking sensors detect movements behind the car and activate the rearview camera to alert officers of a possible ambush. Because the base hardware comes preinstalled with existing police vehicles, the feature can be deployed by simply adding a small module under the dashboard (Stellantis 2018). Due to the ease of implementation, the innovation was quickly rolled out to the existing fleet of police vehicles.

5.3.2 Challenges

Quantity rather than quality. Repurposing requires a broad search strategy that assesses a variety of potential existing solutions for a new problem based on a trial-and-error approach (Cheng et al. 2018). The generalist approach associated with repurposing may come at the expense of foregoing a deep scientific or technological understanding of the underlying causal mechanisms of the innovation that ought to be repurposed (Hanisch and Rake 2021). While short-term innovation successes are possible through haphazard search strategies, there may be negative consequences for long-term purposeful innovation that would require an in-depth understanding of the underlying scientific and technological causal mechanisms of an innovation. Finally, low barriers to entry – particularly when repurposing well-established products – may lead to a multitude of uncoordinated repurposing actions. This causes redundancies and inefficiencies as organizations focus their repurposing-based innovation efforts on low-hanging fruit and quick wins that focus on quantity at the expense of outcome quality (Hanisch and Rake 2021).

Value appropriation. One of the biggest challenges hindering repurposing is the difficulty of appropriating the value of a repurposed product. Candidates for repurposing have been on the market or at least under development for some time. Examples from the pharmaceutical industry indicate that it may take several years or even decades to discover a new use for an existing product (Pushpakom et al. 2019). Similarly, when Dr. Spencer Silver, a scientist at 3M, discovered a new adhesive that could be peeled back, he struggled for years to

find a useful application for this technology (earning him the nickname “Mr. Persistent”), a process that eventually culminated in the development of Post-it® notes (3M 2022). Such long timeframes for repurposing are fraught with challenges if companies want to protect the intellectual property of the repurposed innovation. Effective patent protection is usually difficult because the corresponding patents may have already expired or will expire in the near future (Pushpakom et al. 2019). Further questions regarding the patentability of repurposed innovations may arise if parts of the relevant technological knowledge already belong to the prior art and are common knowledge. Other forms of protection – such as market exclusivity for pharmaceuticals – may not provide sufficient incentives to invest in repurposing (Pushpakom et al. 2019).

5.4 Managing Repurposing

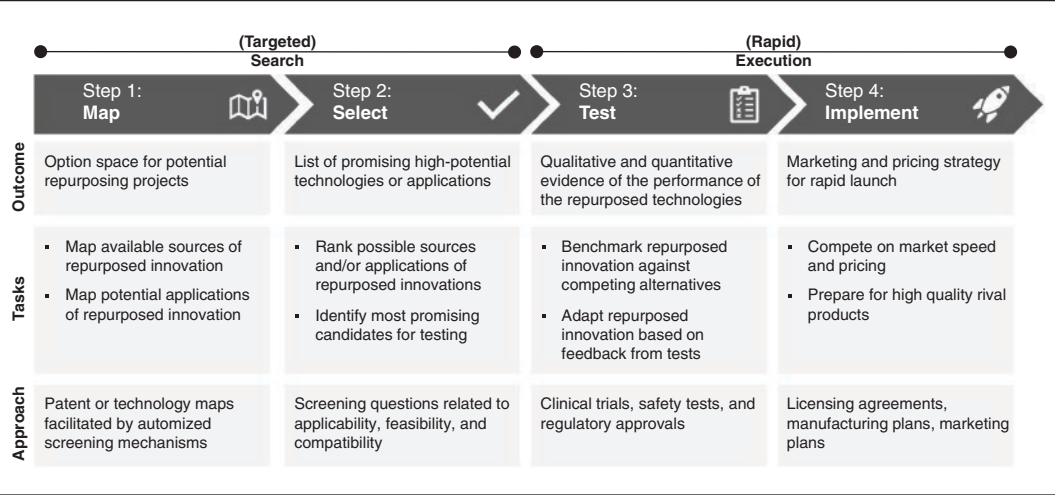
Repurposing can complement new product development strategies and open up new avenues for innovation. Repurposing presents appealing prospects to rejuvenate products by actively pursuing new applications beyond the original area, especially for products that are close to the end of their life cycle. The innovative elements are not in a technological breakthrough, but rather in reinventing a context in which the technology can make a difference. In this way, repurposing can provide companies with an extended revenue stream. If successful, repurposing also reduces the pressure on R&D departments to develop new technologies at a rapid pace and creates the time and financial space for ambitious projects. From an implementation perspective, repurposing is less dependent on technological know-how and instead relies on broad knowledge and inspiration from other contexts. Thus, successful repurposing benefits from diverse teams that draw inspiration from a variety of sources to find new uses for existing products. In this way, repurposing does not compete with the scarce resources of the R&D team and in many cases could be supported by other departments such as marketing and sales.

5.4.1 The Repurposing Process

Repurposing requires an institutionalized process to unleash its full potential as an innovation strategy in organizations. It is important to recognize that planned repurposing goes beyond examples of serendipitous discoveries and discoveries by coincidence. The repurposing process consists of four consecutive steps in which the first two form a subprocess of targeted search, and the last two form a subprocess of rapid execution (see Figure 5.4).

From a process perspective, mapping is the central activity that initiates the subprocess of targeted search that defines the search space. Mapping describes the process of conducting a systematic assessment of the available sources which lead to repurposed innovations. Methods for creating patent or technology maps might be useful at this stage of the repurposing process (Lee et al. 2009).

FIGURE 5.4 THE REPURPOSING PROCESS.



For example, the biopharmaceutical company Origenis relies on “Artificial Intelligence to navigate through the immense chemical universe, to identify islands of interesting and novel chemical matter” as their strategy for comprehensive technology mapping (Origenis 2022). Hence, the first step of mapping requires identifying known technologies that may be repurposed and then delimiting a target space of problems to which the technology could be applied.

In the second step, companies willing to repurpose must identify and select the most promising solution(s) to be developed for a new application. The innovation literature provides a rich set of useful tools for selecting the most promising innovation projects. For example, screening questions may serve as a starting point for a structured discussion to assess the potential costs and benefits of the repurposing project. These screening questions enable managers to assess the role of the customer (e.g., market, pricing, and compatibility questions), the competitive position, including an assessment of the firms’ and its competitors’ capabilities, and the timing and costs of the repurposing project (Schilling 2020). After assessing the potential costs and benefits, managers can use scoring methods to rank the most promising project candidates according to their evaluation of a set of criteria, including strategic fit as well as market and technology risk. Where applicable, quantitative methods can complement these qualitative methods to assess the potential future financial performance of the various repurposing projects. In addition to these more traditional methods, (internal) crowd feedback mechanisms are useful for prioritizing repurposing projects (Hoornaert et al. 2017).

Rapid execution of the repurposing project begins in step three with testing the repurposed solution against the new targeted functionality. The performance of competing products from the user’s point of view may serve as a benchmark for assessing the performance of the repurposed solution. However, there may be cases in which there is no competing solution available (e.g., because the problem recently emerged or because the repurposed product should meet the

needs of an unserved market). In this case, the generally accepted industry standards for testing the safety and efficacy of the repurposed solution would apply. Based on the feedback obtained in the testing step, the repurposed solution may require adaptation to enhance its performance and/or its appeal to potential customers. However, it may also turn out that the repurposed solution does not meet expectations in terms of functionality – e.g., a drug is not an effective treatment against a specific disease – or in terms of market potential. For example, Gilead Sciences and Hofmann-La Roche aimed to repurpose Remdesivir, a drug that did not show clinical efficacy against Ebola or the Marburg virus, as a treatment against COVID-19. The most recent clinical results call for further studies but do not unambiguously support moderately positive earlier assessments (Ansems et al. 2021). In cases where the tests of repurposed products lead to negative or ambiguous results, managers should stop further development of the repurposed solution, select the best suitable alternative, and start the testing phase again.

The fourth and final step is to implement and actively market the repurposed solution. To be successful, companies need to act quickly and introduce the repurposed solution as fast as possible. The reason is that the potential for protecting the repurposed solution through intellectual property rights might be limited (see Section 5.2.3), which is likely to lead to rapidly increasing competition once the commercial potential of the repurposed innovation becomes apparent. Therefore, a rapid and widespread market introduction is critical to establish an industry standard in unserved markets, to tie up strategic resources, and to achieve cost advantages through economies of scale and learning curve effects that enable an aggressive pricing strategy to preempt competitor market entry (Lieberman and Montgomery 1988). In either case, managers must be aware that competitors are closely monitoring their success and may enter the market with products that are either repurposed as well and offer the same or higher performance or even with newly developed products that are tailored to the target market and that outperform the repurposed alternatives.

5.4.2 Digitalization: Enabling Search and Validation

Emerging digital technologies provide new opportunities to leverage the full potential of repurposing. Often, repurposing is hindered by the amount of data that must be processed to map, select, and test technologies for their repurposing potential. For example, sourcing external knowledge through idea scouting or crowdsourcing quickly becomes impractical when the search space is very large and potentially detached from the context of the original solutions (Piezunka and Dahlander 2015). To illustrate the magnitude of the problem, consider the recent trend among pharmaceutical companies to open their libraries of already identified but not yet successfully developed (chemical) compounds to the broader academic research community to find new use cases. AstraZeneca alone made more than 250,000 compounds available to researchers (AstraZeneca 2021). This high number of potential solutions from just one company vividly demonstrates the impossibility of manually scanning these

potential solutions and matching them with new applications. For this reason, digital analysis and processing technologies such as artificial intelligence have a very special role to play in the context of repurposing.

Artificial intelligence (AI) – particularly information extraction methods – as well as methods for analyzing and extracting hidden patterns in large amounts of (big) data, such as gene expressions, chemical structures, genotypes, proteomic data, and electronic health records, are already used to identify potential targets for drug or compound repurposing (Pushpakom et al. 2019; Zhou et al. 2020). For instance, AI can help predict the therapeutic potential of compounds. During the COVID-19 pandemic, AI helped identify promising repurposing candidates to treat the disease, demonstrating its usefulness in the repurposing context (Zhou et al. 2020). The ability to identify drug candidates that are suitable for repurposing and can move rapidly into clinical testing makes AI a core method to advance the repurposing of existing drugs while improving the effectiveness and efficacy of drug development (Zhou et al. 2020).

The use of AI for repurposing is, of course, not restricted to repurposing drugs for new disease areas. The IT and software industries provide an example where AI is used to identify software components that can be repurposed in the development of new software (Wangoo 2018). An AI algorithm is able to search forums such as GitHub to identify code that could be reused in a different context and even in other programming languages (Nguyen et al. 2020). More generally, AI opens up opportunities for conducting insightful analyses of large datasets and, therefore, supports the repurposing of existing products in areas where information processing is the main barrier to innovation, including the search for new innovation opportunities (Haefner et al. 2021). For example, Mounet et al. (2018) used AI to scan more than 100,000 materials to predict which compounds have the potential to create new and interesting materials suitable for battery development. Such advanced analytical methods also enable companies to deal with big data generated by user or customer participation in open innovation processes to identify or test products for repurposing (Del Vecchio et al. 2018).

To take advantage of the opportunities offered by AI in the context of repurposing, companies need to meet certain requirements. In addition to the availability of large amounts of adequate data with minimal biases (Lee et al. 2018), a company must have employees with data analytics skills to support the creation of new combinations of technologies as well as the reuse of existing solutions in different contexts (Wu et al. 2019). Employees with data analytic skills are required in the context of repurposing to facilitate product development that requires sifting through broad knowledge domains or vast amounts of information (Wu et al. 2020). At the same time, recognizing patterns alone is not enough. Complementing this, technical experts such as chemists or engineers must evaluate feasibility in terms of implementation costs and speed, while managers must assess the marketability of the technologies in terms of demand and pricing.

Successful repurposing requires not only data analytical skills but also a secure IT infrastructure for data exchange. Innovation repurposing is an inherently collaborative approach and often transcends organizational and technical boundaries.

Especially when the technology originates outside the focal organization's boundaries or a company wishes to open its technology portfolio to others, it is often of vital interest to the parties that the intellectual property flows are traceable and verifiable. This becomes relevant for assessing potential intellectual property infringements, determining licensing and royalty fees, or simply learning about new applications. Blockchains offer a promising solution to increase transparency in data sharing by enabling immutable and secure data records that can be used to track intellectual property flows (Goldsby and Hanisch 2022; Hanisch et al. 2022). IPwe (IPwe.com), for example, is a specialized provider of blockchain-powered intellectual property transactions that enables companies to track and manage their innovation portfolio. In addition, blockchains can provide the bedrock for secure and accountable data exchange, as recently demonstrated by a pilot project between IBM and the FDA to share oncology-related data.

5.5 Conclusion

Repurposing is a promising innovation approach that exploits untapped potential, reduces the cost of developing new products, and shortens innovation cycles. For managers, repurposing is therefore a crucial enabler to build and expand their competitive advantage and respond to new trends in a more dynamic and targeted way. With the advent of digital technologies such as AI, which automizes the effective screening of technologies on an unprecedented scale, and blockchains, which securely track data flows, repurposing is likely to become an increasingly dominant paradigm to innovation in the coming years, especially in fields that rely heavily on recombinational logic, such as materials science, chemistry, biology, and information technology. For example, a recent study has demonstrated how chemical waste products can be converted into useful drugs using complex computer algorithms that recombine chemical components (Wołos et al. 2022). It is critical for managers to recognize that the next breakthrough does not necessarily have to come from *de novo* developments made in their own R&D labs but that they can leverage existing technologies whose potential for another field has simply been overlooked.

Despite its merits, innovation repurposing also poses some risks that managers should keep in mind. Although repurposing can shorten development times, there is no guarantee that a particular technology will work in a new context just because it has similar properties. Thus, testing and evaluating new use cases together with technological fine-tuning can be tedious and costly. In addition, repurposed technologies may incur follow-on costs such as licensing and royalty fees, as well as lower profit margins resulting from the high risk of imitation, since repurposed technologies are often more difficult to patent or keep exclusive. For this reason, managers should view repurposing as a complementary innovation strategy alongside ambitious but inherently risky *de novo* developments. Overall, repurposing is an important pillar in a balanced innovation portfolio.

Note

- 1 The fact that the underlying product is already known and may be used and marketed for a specific purpose does not mean that repurposing is an innovation strategy that is available at almost no cost. Although the costs of repurposed innovations are likely to be lower than for de novo developments, they can still be substantial (Breckenridge and Jacob 2019). Companies may need to invest in studies that demonstrate feasibility, efficacy, or safety and conduct regulatory approval procedures. While these procedures are common in the health care industry, they also occur in manufacturing industries such as aviation. Software companies may not need regulatory approval but would need to test whether the repurposed code interacts as intended with other code in a software package.

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