

# Is the Sharing Economy a Valid Option for Scientific Research Technologies in Emerging Economies?

—YOMNA SALEH

Scienup, Giza 12511, Egypt

—SHERWAT ELWAN IBRAHIM 

American University in Cairo,  
Cairo 11835, Egypt

(Corresponding author: Sherwat Elwan Ibrahim.)

IEEE DOI 10.1109/EMR.2018.2863271

**Key words:** Sharing economy, scientific research, emerging economy, sharing models

## INTRODUCTION

**T**ECHNOLOGICAL advancement is occurring at unprecedented rates. Not only does that make scientific innovations more critical, but also very expensive. Experimenting costs for new technologies is outgrowing available funding and resources. Imaging microscopy for research, as an example, can cost in the millions of US dollars. New generations of these complex scientific research technologies are frequent and may have similar life cycles as smart phones.

In these dynamic technological situations, it becomes challenging for scientists and innovators to afford the necessary equipment and maintenance for these technologies. Given the high costs and specialization level of scientific facilities, a sharing model may be a feasible option; especially in emerging economies where resources are limited.

Sharing has been a long-standing concept in human interaction. Information and communication technologies (ICTs) have led to a recent rise of the “sharing economy” or “collaborative consumption”. Much of the recent discussion around the sharing economy has been focused on disruptive retail, individual consumer, oriented companies such as Uber and Airbnb. The potential for

sharing economy principles can expand beyond these consumer transportation and hospitality sectors.

ICT can connect supply with demand irrespective of sector, industry and beyond common business relationships. Evolving applications for a sharing economy still lack a clear definition and the model has varying characterizations from both academics and practitioners. While the sharing economy umbrella can be relatively capacious, it is important to have clear defining guidelines when exploring the model in new domains like scientific research; an ecosystem that is innovative by definition but still often traditional in its dynamics.

We evaluate the sharing economy as a platform for the scientific research field. We discuss defining characteristics of the sharing economy that can be used to explore opportunities and limitations in the scientific research ecosystem.

## THE SHARING ECONOMY: A DEFINITION

The current excitement surrounding sharing economies has academics and practitioners addressing the basic notion of the sharing economy. There are criticisms such as that “the presence of profit motives, the absence of feelings of community, and expectations of reciprocity”

defies the essence of sharing [1]. For these critics, “the sharing economy is just a fancy word for ‘rental’” [2]. Alternatively, there have been multiple advocating attempts to define the sharing economy, and differentiate it from both traditional sharing as well as other business models like renting.

At the core of the sharing model lies the notion of *exploiting idle resources*. Customers in a sharing economy aim to receive goods and services more efficiently by moving *from ownership to access*. This shift is usually achieved, through *peer-to-peer exchange* between individuals or entities and not by trading companies. But perhaps the most influencing factor in making sharing happen at such a scale today is the ICT component.

Before the Internet, both sharing and renting were available in another form, but usually not efficient, with more barriers. As ICT advanced, transaction costs have significantly reduced, the search for what is required is easier, and billing is completed more efficiently through online payments [3]. These technological platforms act both as collective data bases as well as moderating channels devoted to facilitating exchange.

Public ICT networks help to create collective accountability, mutual benefits, and the chance to democratize access to products and services. Take for example, the industrial sector. It is not uncommon for manufacturers to subcontract work to other companies when large orders are obtained. While characteristics of

traditional sharing are found, usually technology takes no part in moderating such interactions, and there is more dependency on personal relations and face-to-face interactions, leaving the model distant from a sharing economy philosophy [4].

The sharing economy term has been misused by companies that use web or mobile technologies to access products or services for sale, like Zipcar for car rentals. There is a clear model for matching supply with demand using technology, but zero collaboration or “sharing” of idle goods is actually involved. It is still a rental process that is owned and moderated by trading companies.

Summarizing these initial thoughts, Table 1 shows the four sharing economy characteristics across different business models.

In the scientific research domain, the sharing concept is illustrated through research collaboration in equipment, facilities, and intellectual assets. With insufficient resources, access, versus ownership, is a viable solution.

Technology sharing currently happens at a relatively minor scale. The full potential is not yet realized and underutilized scientific research capacities are still prevalent.

Online tools can help in the scientific research sharing model. Peer-to-peer communication and idle resources exploitation can be pursued with online tools to more effectively utilize valuable scientific research technological resources.

## CURRENT SHARING MODELS IN SCIENTIFIC RESEARCH

Some models that facilitate sharing and collaboration in scientific research technology currently exist. These examples can help further understanding of acceptance or resistance of scientific ecosystems sharing economy dynamics.

One example is the case of University College of London (UCL)—London’s leading multidisciplinary university. UCL includes a research equipment directory that can be accessed online. The searchable database is only accessible to UCL researchers and staff. The user can search the database and contact equipment owners through the system.

This situation is a straightforward peer-to-peer model between faculty and researchers, moderated through a technology channel for utilizing idle resources. While this tool can offer organizational efficiency for UCL, the intra-organizational dynamic challenges the open nature of sharing economy models. For example, it is unlike Airbnb, which focuses on the broader community.

This closed access is not enough to fully realize the potentials of idle resources beyond the organizational border, missing out on collaboration opportunities with other leading research concentrations. Although this model is fully adopted by University administration and would not face privacy concerns that might face more open sharing models. With a high level of specialization and competitiveness in scientific research this approach can work as a more secure option.

Organizations seeking disruptive innovations and monetization from scientific services are likely to find this sharing model limiting.

A more democratized model occurs in the case of the Engineering and

**Table 1. Matching Different Models Against Sharing Economy Characteristics**

Variable	Sharing economy	Renting	Subcontracting	On-demand economy
Idle capacity	✓	✓	✓ or ×	×
Access instead of ownership	✓	✓	✓	×
Peer-to-peer sharing	✓	✓ or ×	×	✓ or ×
Technology platforms	✓	×	×	✓

Physical Sciences Research Council (EPSRC) in the United Kingdom (UK). EPSRC is the main government agency that funds research in engineering and physical sciences in the UK, with annual investment of 800 million pounds sterling. They started an initiative to encourage access of equipment versus ownership through peer-to-peer sharing and exchange of idle resources nationwide.

At the core of the EPSRC initiative lies a virtual channel called *equipment.data* in attempts its use is more acceptable nationwide [5]. Their platform *equipment.data* aims at improving visibility and utilization of UK research equipment. The platform technology is currently only a catalogue, and has the potential to be more. It can expand to act as a moderating channel for collective accountability, a sharing economy characteristic.

A lesson learned from *equipment.data* is that a public-sector initiative is a double-edged sword. With government dominating scientific research funds and national research strategies, *equipment.data* has the authority to collect data at a massive scale and facilitate accessibility; the platform archive contains 15,490 items from 52 organizations. Alternatively, sustaining the platform's operations can be challenging for the public sector. The initiative can be marginalized with management changing, and can suffer without financial sustainability plans [6]. This could be a promising sharing economy model, but without an effective tool that is functional and sustainable, it becomes fragile.

A third example that adopts a rather entrepreneurial mindset can be seen in the case of the company called "Science Exchange", a private US-based company that was launched in 2011 as an online platform to help researchers find scientific services. This company has been scaling the

model with a mission to globally foster collaboration.

The company first created an online "yellow pages" for scientific facilities and services from academic and public institutions. These resources, without the online yellow pages, would otherwise be difficult to find or access. They also facilitated the exchange through a systemized process moderated online.

The story of Science Exchange begins with Elizabeth Iorn the founder, who was a postdoctoral researcher struggling to access needed resources to finish her research when she decided to be an entrepreneur. Science Exchange was started as a promising research and development (R&D) sharing economy application. As a privately-owned company operational and financial sustainability is critical. Access to data and data collection is more complex than for a publicly owned funding agency.

Currently, the company acts as a marketplace for managing outsourced research and development. This characteristic weakens its sharing economy characterization. Customers can gain access to resources, instead of requiring ownership, and technology channels are used to facilitate the process. But, they only host approved service providers from commercial organizations or core facilities. Thus, openness exists on the demand side but not the supply side, limiting its sharing economy characterization.

Accordingly, the peer-to-peer component is now challenged. Whether the used resources can be considered idle is debatable. There might be many hypotheses on why the company took this servitization path and why it has been effective for them. It might have been influenced by financial motivation, difficulty to

collect mass data on providers, or the sophisticated nature of scientific research. In all cases, the company still follows its announced strategic mission to enable breakthrough scientific discoveries. With a recent investment of \$28 million in funding, Science Exchange is a promising startup within in the global R&D domain.

Another company is "Scienup". Scienup is an entrepreneurial startup located in Egypt. This company is targeting emerging economy markets in the Middle East and Africa. The company was founded to democratize access to essential equipment for researchers and innovators, reduce duplication nationally, and free up scarce resources for other investments.

Scienup's model is driven by sharing economy characteristics. It provides access to scientific services and research collaborations by connecting supply and demand sides through an online platform, which both list and moderate equipment sharing. The company is targeting idle resources to be exchanged between peers with openness for both supply and demand sides.

These four cases relationships to sharing economy principles are summarized in Table 2.

## SCIENTIFIC RESEARCH SHARING IN EMERGING ECONOMIES

According to a recent *UNESCO Science Report* [7], developed countries still dominate global R&D investment. Yet, a strong public commitment to R&D in emerging markets was observed as a trend. There is now ample opportunity for a company like Scienup to enable affordable access to science & innovation in emerging economy nations. As a first-mover in the region for the R&D market, uncertainty still exists.

A sharing economy model through a barrier and enabler analysis is now discussed. To further explore the applicability of the sharing economy model for Scienup, and identify potential issues, we interviewed three stakeholder groups, as shown in Table 3.

First, the demand side stakeholders represented practicing researchers, innovators and inventors. These stakeholders need access to expensive equipment to complete their scientific endeavors and research projects. Typically, at some point in the innovation process, they may require a piece of equipment not available to them by their organizations.

An example demand side stakeholder, a senior researcher, stated:

“Disparities in funding across nations and even within the same organization makes it extremely difficult to purchase all the technologies you need. Collaboration although difficult to manage is indispensable for quality research work”.

One of the researchers interviewed, affiliated by a public institute, commented, “the first problem in accessing needed equipment, is knowing who has the equipment and if it is available. Answering these questions can take days, weeks, or months”.

Offline searches for available facilities is a frustrating process, which depends on existing personal or team networks. Another researcher, affiliated with a private institute added: “Even if I became aware of where I can find a piece of equipment. I still need to find the person in charge, explore whether they are interested in collaboration, and have repeated communication to even schedule an initial meeting”.

These practicing scientific researchers confirm that having a one stop shop to both allocate and moderate equipment sharing could be game changing for their research work; an opportunity for a Scienup-like sharing community to be such a channel. While a sharing economy can offer democratized access to serve the demand side, ensuring a valid motive for a supplier to be part of the database is also important.

The second stakeholder category we spoke with included lab managers and owners, representing the supply side. They are the asset service providers. These actors included academics who supervised research groups, core multi-lab facility managers, or privately-owned research center owners. The motives for each of these providers differ. Understanding motivations to be part of a Scienup sharing network is important.

An academic who owns one of the biggest labs in his department, when

asked about the sharing model answered: “I highly encourage research collaboration with other professors as long as there is common interest in research areas and complementing expertise. Charging a fee for exchanging physical assets would be my only motive for collaboration if such common interest and complementary expertise did not exist. I have costs that I need to cover, both for operating and maintaining my equipment”.

Another academic from the same department with less access to sophisticated equipment commented: “Although I might have less equipment in my lab, I always open the door for collaboration as long as others are doing the similar work. I would do this without requesting any financial compensation. Mutual access would help both of our projects progress; it’s a win-win situation.”

For core facility managers, a more straight forward motivation exists, and adoption for the sharing model was more welcomed. “This is what we want to do. In order to be financially sustainable we need to reach users who can pay in exchange for our services, otherwise we won’t be able to operate”.

Moreover, institutes outside of urban areas were more likely to take action in adopting such an electronic network sharing model. For them online channels can be much easier, faster, and more scalable than offline networks as affected by physical

**Table 2. Assessing Different Models in Scientific Research Against Sharing Economy Characteristics**

	UCL research equipment directory	Equipment.data	science exchange	scienup
Idle capacity	✓	✓	Debatable	✓
Access instead of ownership	✓	✓	✓	✓
Peer-to-peer sharing	✓	✓	×	✓
Online database	✓	✓	✓	✓
Technology moderator	✓	×	✓	✓
Open access	×	✓	✓	✓
Observation	Privacy concerns are minimal	Access to data is easier through governmental authorities	Private sector may offer more effective operations and more promising financial sustainability	As an early stage startup, Scienup is currently assessing the model's context, scale and location



space. One lab manager stated: “This is a very important project and directly aligned with our mission to offer state of the art research facilities to both the scientific community and also support industry towards economic development”.

While commercial scientific service providers are mostly financially motivated, academics can be driven by research collaboration, academic recognition, and sometimes financial rewards.

To be able to attract more providers to be listed on a sharing network like Scienup, such motives need to be considered when designing the online platform user interaction process. While this group of stakeholders has the authority over equipment operations, the ownership scheme of equipment as assets may be more complicated. This issues might affect the final decision of publicly listing scientific research technology capacity.

The final stakeholder category we interviewed was a group of actors who may affect the decision-making process for equipment sharing. These stakeholders include funding agencies and university administration offices. Efficient utilization of resources is key, especially scarce technology equipment resources. These systems can enhance competitiveness at both organizational and national levels.

University administration is strongly supportive of organizing and

allocating equipment and personal effectively in order to avoid idle resources. One university administrator commented: “I came to this position to find that we don’t have a single exhaustive list of equipment and facilities compiled, which can be available to all faculty to exploit”.

They also referred with frustration to one piece of equipment residing in the organization unused for 6 years, “this is thousands of US dollars going to waste because it was purchased by a researcher who left the organization, and today no one even knows that it exists”.

While a solution like Scienup might sound ideal for administrative goals, some challenges might need to be resolved for a complete adoption process. Another manager shared his experience with collective sharing platform for organization facilities, “with the technical difficulties we faced to build a system in-house, Scienup can be an effective alternative. However, a big challenge remains for mobilizing the system among all researchers, some are still resistant to collaboration.”

Therefore, sharing economy platforms need to promote a sharing culture, in addition to facilitating the sharing process. Even though most interviewees were receptive and encouraging of such a platform, some were apprehensive about having their facilities listed publicly. “A privately accessed community can work for us and our alliances better. It is hard to predict the outcome when its publicly available for everyone to navigate through our facilities.”

Although a closed community defies the purpose of access democratization, such concerns still need to be addressed and resolved. Similar dynamics might have been the reason behind the shifted model for “science exchange”.

With funding agencies, return on investment is more easily met when idle equipment is widely used. A manager for one of the biggest nongovernmental research funds was very excited about sharing platforms. She stated: “this is something we wanted to do for a long time; find an effective way to utilize equipment that we fund by other research groups when funded projects are over”.

Not only were they willing to be part of the platform but also to fund it if necessary. They find such tools can not only foster research collaborations, but to they can also offer a revenue stream to cover equipment maintenance and consumable costs. She also commented that, “this would also reduce purchase duplication saving capital for other investments”. When authority over equipment purchase and long-term ownership is dominated by funding agencies, strong partnerships with them can be game changing for players in the ecosystem.

## STEPS FORWARD

Major challenges facing scientific research include low rates of expenditure on scientific research facilities, and lack of cooperation and coordination among academic and commercial research institutes. A new sharing economy application can greatly enhance scientific research and stretch resources.

Looking closely at current sharing economy models across sectors we find common enabling characteristics, moving from ownership to democratized access.

**Table 3. Summary of Interviewees Profiles**

Stakeholders category	Number of interviews	Positions of interviewees
Demand side	3	1 senior researcher 2 researchers, one each from the public and private sector
Supply side	4	2 faculty members 2 core facility managers
Influencing group	4	3 University administrative leaders 1 non-governmental fund manager

There is a need for a sustainable business model to empower peer-to-peer sharing of idle scientific research equipment capacity to aggregate data and moderate exchange.

While exploring similar models in the scientific research domain, opportunities and challenges surfaced. Need at the demand side is obvious and there is plenty of room to serve them. By satisfying the right supplier motive, suppliers of these assets would find it appealing to partake in the sharing economy. With administration change management and a strong partnership with funding agencies scientific research sharing models may have an easier and more successful adoption path.

Democratized access might be challenged by privacy concerns and difficult access to mass data. This situation may lead to a more closed version of supply, demand or both. Deficiencies in platform operations or design, might affect value and long-term sustainability. Without an active role of a sharing economy platform to promote a collaboration culture, a peer-to-peer model would not be feasible.

Figure 1 introduces a conceptual framework for sharing economy

models based on some of our observations and findings. Reaching the full potential of a sharing economy can best be found when moving from ownership of products and services to a state of democratized access. This model begins with the characteristics of traditional sharing in terms of moving from ownership to access to make use of idle capacity through peer-to-peer sharing.

Technology is best viewed as a democratization of access enabler, where 1) a collective database is a tool that offers available technology capacity visibility to everyone and 2) an exchange moderator that supports the work sharing process across large scale communities.

Without careful governance and planning, this democratization state situation could devolve from a sharing economy model and back to an access model if sharing economy platforms shift into a servitization model or restrict access to a closed platform, as shown in Figure 1.

In investigating a sharing economy model for scientific research, it is important to keep the overall objective in sight; supporting a scientific and

innovation ecosystem to create the breakthroughs of tomorrow. Maintaining a broad perspective on the sharing economy can help actors understand, adapt to, and benefit from this evolution.

In summary, managers and owners of these capacities can use sharing economy dynamics to transform how R&D operates in today's competitive markets. This tool can support innovation opportunities and effectively address funding challenges.

Being part of a sharing economy platform offers the visibility, accessibility, and convenience to initiate collaborations beyond personal networks. Exploiting underutilized resources would enhance institutional capacity and free up resources for other investments. This would also allow for acquisition of capital items, which would attract ambitious researchers who are seeking handy up to date well-maintained resources. With such presence, efficiency, and network, opportunities are higher to attract more funds, increase academia-academia or academia-industry collaboration, and commercialize innovative research output.

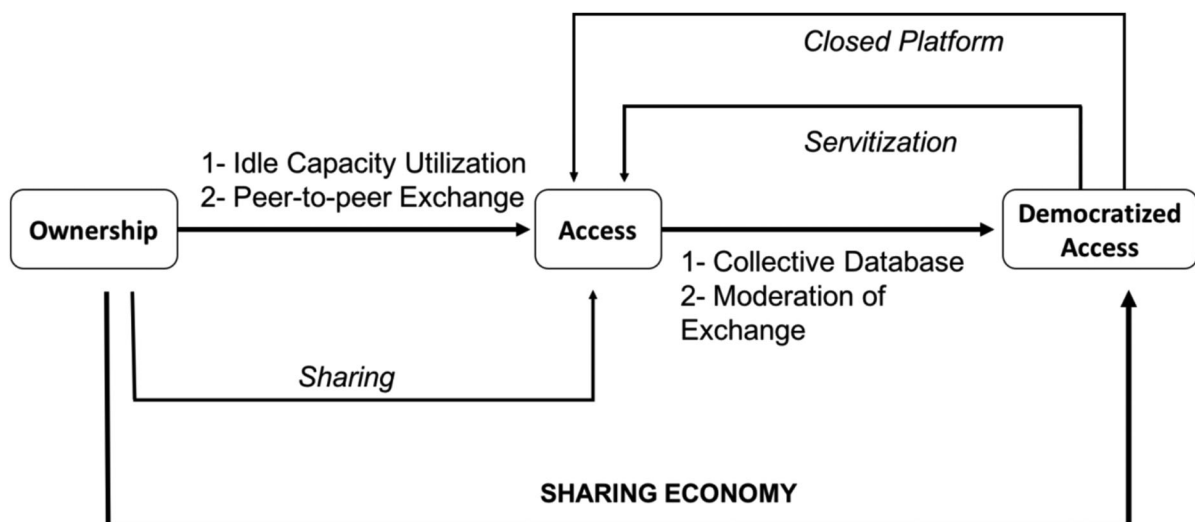


Figure 1. Guiding characteristics for sharing economy models.

## REFERENCES

- [1] R. Belk, "You are what you can access: Sharing and collaborative consumption online," *J. Bus. Res.*, vol. 67, no. 8, pp. 1595–1600, 2014.
- [2] R. Belk, "Extended self in a digital world," *J. Consum. Res.*, vol. 40, no. 3, pp. 477–500, 2014.
- [3] "The rise of the sharing economy," 2013. [Online]. Available: <https://www.economist.com/news/leaders/21573104-internet-everything-hire-rise-sharing-economy>
- [4] K. Griffin, *Studies in Development Strategy and Systemic Transformation*. London, U.K.: Palgrave Macmillan, 2000.
- [5] "Equipment data: Enabling access to UK HE research equipment," [Online]. Available: <http://equipment.data.ac.uk/>. Accessed: Aug. 20, 2017.
- [6] "Sharing results: Government innovation in the 'We economy,'" 2016, [https://www.accenture.com/us-en/\\_acnmedia/Accenture/next-gen/insight-sharing-economy/documents/Accenture-Sharing-Pulse-Survey.pdf](https://www.accenture.com/us-en/_acnmedia/Accenture/next-gen/insight-sharing-economy/documents/Accenture-Sharing-Pulse-Survey.pdf)
- [7] UNESCO, "UNESCO science report 2010—Arab States," UNESCO, Paris, France, 2010.