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To cite this article: Katarzyna Cieslik, Art Dewulf & J. Marc Foggin (2022) Investigating project sustainability: technology as a development object in a community-based project in Naryn, Kyrgyzstan, *Oxford Development Studies*, 50:4, 289-306, DOI: [10.1080/13600818.2022.2039607](https://doi.org/10.1080/13600818.2022.2039607)

To link to this article: <https://doi.org/10.1080/13600818.2022.2039607>



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Published online: 16 Feb 2022.



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Investigating project sustainability: technology as a development object in a community-based project in Naryn, Kyrgyzstan

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ABSTRACT


The imperative of project sustainability has become explicit policy within development. This is especially true for technology transfer: ‘development objects’ are to be used by prospective beneficiaries long after the project’s closure. We argue that the link between project sustainability, technology and ‘success’ requires deeper scrutiny. We investigate a community-based project in Naryn, Kyrgyzstan, which included the transfer of smartphones, weather stations and camera traps. Upon the project’s closure, we compare the stakeholders’ viewpoints regarding the future use of the equipment, showing how technological objects attract new actors into the project’s network, change its course and enhance its impact. We use actor-network theory to explain how development objects shape development processes by generating own networks and transforming social relations of power. We propose a dynamic view of sustainability as: (i) continuation of delivery of project’s goods and services, (ii) durability of the achieved changes and (iii) feasibility of independent growth..

KEYWORDS

Project sustainability; technology; actor-network theory; development object; Kyrgyzstan; ANT

Introduction

Development interventions are under increasing pressure to perform not only in terms of time-specific impacts but also with regard to tangible sustainability prospects (Mog, 2004; OECD, 2019; Swidler & Watkins, 2009). Projects are expected to reach their objectives within a specific time frame but also to continue to deliver the benefits to the target groups after the funding from a donor terminates (Cassidy, Leviton, & Hunter, 2006; Lungo, Mavole, & Martin, 2017). This is achieved through community participation – involving local stakeholders in project planning, implementation and management (Ahmad & Talib, 2010). In the case of projects that involve technology, local participation is to ensure that the gifted ‘development objects’ continue to be used by prospective beneficiaries for many years after the project’s closure (Pade, Mallinson, & Sewry, 2008). At the same time, a growing body of research evidences that development projects are difficult to sustain beyond the point when the donor support ceases and the external staff relinquish control (Lungo et al., 2017; Wardle & Zakiriaeva, 2018). In some cases, the attempted technology transfer frustrates rather than assists the recipient country development efforts (Avgerou & Walsham, 2000; Fu, Pietrobelli, & Soete, 2011). Despite these criticisms, transfer, diffusion and adoption theories fuel positivistic views on technology for development (tech4dev), ranging from crop improvement and water and sanitation infrastructure to digital applications in health and education (Pansera & Martinez, 2017). Against this

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background, we ask: what is the role of the gifted technological objects in ensuring the project's continuation beyond its timeframe? Can technology facilitate project sustainability? What is the relationship between a project's sustainability, technology and 'success'?

In this paper, we use the conceptual lens of Actor-Network Theory (ANT) to show how technology shapes the social life of projects by generating own networks and relations of power (Law, 2002, 1987). We draw on an empirical case study of a community based conservation project in Naryn, Kyrgyzstan: the Mountain Environmental Virtual Observatory (M-EVO). The aim of M-EVO was to generate ecosystem knowledge to support sustainable livelihoods through participatory environmental monitoring. Technology transfer (smartphones, weather stations and camera traps) was a core component of the project. At the point of project closure, we investigated the perspectives of the local stakeholders regarding the future of M-EVO. Our qualitative analysis reveals that while M-EVO has a high chance of continuing, local stakeholders adapt it for purposes that do not always match the initial ideas of the implementers and donors. This is achieved through the flexible use of technology: the gifted 'development objects' attract new actors into the project's network, change its course and enhance its impact (Latour, 2005; Law & Callon, 1992). We show how the sustainability prospects of development projects depend on the creation of effective local networks that bind together individual and institutional actors as well as technological artefacts, a process that is dependent on the dynamic relations of power (Stanforth, 2007).

With this paper, we argue that ANT offers ways of thinking about the technology transfer problems that diffusion and adoption theories fail to address (Elbanna, 2011). By replacing the concept of 'technology transfer' with 'translation' (the process of formation of a new actor-network), ANT gives attention to 'unpredictable ends and development processes of programs or projects' (Birke & Knierim, 2020, p. 593; see Swidler & Watkins, 2009). Through ANT's micro-level perspective, we analyse why some actor-networks succeed while others fail (Birke & Knierim, 2020). We show that technological objects are powerful actors that shape and configure socio-technical landscapes in their contexts of application. Accordingly, the project sustainability imperative carries a false premise of a situational permanence while project realities often shift and stakeholders' interests may conflict. Drawing on our results, we introduce a distinction between three dimensions of project sustainability: (i) continuation of delivery of a project's goods and services, (ii) durability of the achieved changes and (iii) feasibility of independent growth. With these findings, we aim to inform the academic debate on the utility of the sustainability imperative within the development sector, and the role of technology beyond the project timeframe.

The paper is structured as follows: we begin by describing the increased pressure on project sustainability within the development sector. Drawing on actor-network theory, we then frame technology as a development object meant to extend projects' timeframe and present an overview of ANT uses in development studies. In the second part of the paper we introduce our empirical case study of the M-EVO project in Naryn, Kyrgyzstan, and use it to substantiate the criticism we pose to the current sustainability doctrine. We then propose three alternative 'sustainability dimensions' that accommodate the dynamically fluctuating social realities as well as the changing needs and preferences of stakeholders. The last section concludes.

Project sustainability

For the purpose of this paper, we define project sustainability as the ability of an intervention to continue its operation after the funding and support from the donor ceases (Lungo et al., 2017; Myers, Fisher, Pickering, & Garnett, 2014). The continued maintenance of development projects varies across contexts and results from a number of intertwined factors, ranging from project management, through institutional setting, to environmental characteristics (Ahmad & Talib, 2010; Silvius, Kampinga, Paniagua, & Mooi, 2017; Sparks & Rutkowski, 2016). Within the development industry, increased awareness of environmental sustainability issues has its roots in both *The Limits to Growth* (Meadows, Meadows, Randers, & Behrens, 1972) and the Brundtland reports (WCED,

1987), which emphasized the need to limit the use environmental resources through technology and social organizations. Project sustainability, on the other hand, has become a prominent topic within the development sector following the Paris Declaration on Aid Effectiveness (2005) and subsequent manifesto known as the Accra Agenda for Action (2009). Both of these documents stress the importance of project sustainability as the key factor for improving the quality of development interventions (Rasouli & Kumarasuriyar, 2016).

While some of the academic literature focuses on the survival conditions for particular interventions (a managerial perspective), other literature analyses the systems into which these interventions are introduced (an ecological perspective). Our paper complements these two approaches by considering the interconnections between the project's key stakeholders, its environment and its material infrastructure (development objects) (Heeks & Stanforth, 2015).

Actor-network theory and the social lives of objects

Actor-Network Theory (ANT) provides a lens through which we can study the role of actors (persons, groups, objects and phenomena) in shaping social processes (Michael, 2017). Epistemologically, ANT assumes that relationships and interactions define actors, and they cannot exist without them (Callon, 1986). The uniqueness of the approach lies in recognizing inanimate technological objects as potential potent agents of change (actors) (Law, 1987). Thus, objects are not neutral carriers of value, but fraught with significance for the relations that they materialize (Latour, 2005) which in turn justifies the argument that objects, like persons, have social lives (Appadurai, 1986, p. 67). Accordingly, within ANT, objects might authorize, allow, facilitate, influence, and/or destroy networks/relationships (Latour, 2005). There are two core ANT concepts that are crucial for our analysis here: these are 'translation' and 'black box.'

Exploring how networks evolve, and how new networks form and stabilize while others dissolve, is the main objective of ANT analysis Heeks & Dev, 2013). This process is known as translation: the creation (or reconfiguration) of an actor-network. Translation means building new relationships (Cavalheiro & Joia, 2016); it is a process through which actors recruit other actors into a network where interpretations, interests and motivations align (Birke & Knierim, 2020). Moments of transition (such as a project's closure) are of special importance: they embody the shift (or 'translation') in the process of a techno-organizational intervention (project) which in turn is associated with reconfigurations of power relations and the creation of a new network (Elbanna, 2011; Tatnall, 2011).

At times, stable networks may temporarily become black boxes: entities whose construction and functioning needs no explanation, as they are only known for their utilities (Penteado et al., 2019). A 'black box' is a combination of actors whose internal workings are obscured from view, making them appear as a singular entity (Latour, 1987). Black-boxing is also a process: a translation that 'transforms a complex system into a simple tool that performs a given action really well, and so nobody is questioning its operating assumptions and principles' (Stockbruegger & Bueger, 2017, p. 52). Though intrinsically still a network, a black box functions as a single entity and its operating principles and relationships evade scrutiny. Through the concepts of translation and black-boxing, ANT analysis reveals how networks and their dynamism are fundamental to development. In the next section, we provide a brief overview of the uses of ANT in development studies to date.

ANT in development research

The theory and processes of technological change (innovation, transfer, diffusion, adaptation, adoption) have always been central to development, but the penetration of technology into all aspects of development has seen a sharp increase over the past decade (Heeks & Dev, 2013; Heeks & Stanforth, 2015). Unfortunately, ANT has not been extensively used within development studies to date, which Heeks and Stanforth attribute to its methodological, analytical, moral and instrumental challenges (Heeks and Stanforth, 2015). They report that researchers (often

unjustly) find ANT both complex and enigmatic, its ontology unrelatable and its anthropological approach tedious and impractical. Below, however, we review a couple of studies that prove that ANT offers ways of thinking about the technology in development that diffusion and adoption theories fail to address (Elbanna, 2011).

One of the first and widely cited work on ANT in development is a paper by de Laet and Mol (2000) scrutinizing the dynamic nature of material objects in development. Their theory of flexible technology (the Zimbabwe Bush Pump) came in the midst of a heated debate between science and technology studies (STS) and development. The flagships of ‘modern’ development, rapid industrialization and diffusion of innovations, undergo heavy criticism, charged with creating dependencies and patronage relations. A number of other studies followed: Stanforth (2007) analysed the transfer of e-government systems in Sri Lanka and Cordella and Hesse (2014) assessed the implementation of a similar Akshaya e-government project in India, using ANT. They found that a successful translation requires a careful consideration of actors (individuals, institutions, objects such as bank accounts, as well as rules and procedures) which enable networks to develop, substantiate and stabilize. Similarly, research by Dedeke (2017) demonstrated with a case study of sustainable tourism ventures in the Amazon how a single actor can orchestrate the network’s success. Rhodes (2009) applied ANT to study ICT-based telecentres in South Africa and Diaz Andrade and Urquhart (2010) used ANT to diagnose interest misalignment between donors and local stakeholders in an ICT4D project in rural Peru. Penteado et al. (2019) drew on ANT to study technology transfer using the example of solar ice machines in the Brazilian Amazon. More recently, Birke and Knierim (2020) used the four stage model of ANT translation to explain the mixed results of an ICT-based agricultural extension project in Ethiopia.

All of the above studies demonstrate the ANT’s potential contribution to furthering our understanding of development structures and processes. First, as a relational approach, ANT lends specific relevance to international development as it questions the relationships inscribed in the materiality of aid (Lewis & Mosse, 2006). Second, as observed by Heeks and Dev (2013), by allowing human and non-human actors the same status, ANT offers a middle way between social constructivism and technological determinism. Against this background, our unique contribution is exploring yet another unique feature of ANT: by adopting a temporal perspective, ANT offers an analytical lens to study how these relationships evolve in time, which makes it suitable to investigate development projects’ sustainability.

In the following section, we present an empirical case study of a community-based conservation project in Naryn. In our analysis, we apply ANT to analyse the role of technology in shaping the future pathway – and sustainability prospects – of the M-EVO project.

Case study: Naryn agro-ecosystems and local livelihoods

The Kyrgyz Republic is a small, mountainous, landlocked country in Central Asia which experienced a dramatic economic transition in 1991. Over the past thirty years, the collective and state-owned farmlands were re-distributed, the supply of agricultural inputs interrupted, and marketing outlets all but disappeared, resulting in a sharp decline in the economic wellbeing of a majority of rural households (Agadjanian & Gorina, 2019; Crewett, 2012).

Transition, climate change and livelihoods in Naryn, Kyrgyzstan

The largest of Kyrgyzstan’s six provinces, Naryn Oblast, is the poorest part of the country (Dörre & Schütte, 2018; Karpouzoglou et al., 2020). Outside of the few urban areas, the population of Naryn comprises agro-pastoralists: farmers who are also livestock owners, and semi-nomadic herders (Levine et al., 2019). Herders are responsible for the annual migratory livestock movement from the winter grazing locations to the summer pastures in the highlands of the Tian Shan Mountains

(Crewett, 2012; Mestre, 2019). Following the dissolution of the Soviet Union, however, these pasture management systems also changed: land ownership curtailed the herders' mobility and overgrazing in areas closer to settlements degraded pasture quality (Levine et al., 2019; Shigaeva et al., 2016; Yu & Kasymov, 2020).

The legal reforms of 1999 and 2009/2011 introduced a system of community-based natural resource management, under which pastures are to be managed by local user groups, represented by Pasture Committees (Jayity Komitet) working in cooperation with village councils (Ayil Okmotu) (Steimann, 2012). While these changes are gradually improving local governance, the actual practices tend to deviate from the formal arrangements, overgrazing persists and the sustainability of the mountain ecosystems is under threat (Kasymov & Thiel, 2019; Levine et al., 2019; Sagynbekova, 2017). Specifically in Naryn, the effect of human activities on grassland ecosystem function is much greater than even the largely negative impacts of climate change (Wang et al., 2020). For this reason, achieving a better understanding of the environmental dynamics of Naryn and their implications for agro-pastoral livelihoods of mountain communities could help develop potential development pathways for the region (Karpouzoglou et al., 2020). In the next section, we describe the M-EVO project and its ambition to increase the local environmental knowledge base and thus contribute to improved livelihoods.

The project: environmental virtual observatories

The Mountain Environmental Virtual Observatory (M-EVO) was a research-for-development project focussed on the sustainable use of natural resources in mountain regions (Karpouzoglou et al., 2020, 2016).¹ Funded by the UK Research Council program, Ecosystem Services for Poverty Alleviation (ESPA), the project also had a social objective: to alleviate poverty in the mountain regions by generating evidence for improved livelihoods.

Led by a research consortium of British and Dutch universities, the M-EVO project in Kyrgyzstan was implemented by the local partner: the Mountain Societies Research Institute (MSRI) of the University of Central Asia (UCA). Over the period of four years, the M-EVO team worked with the communities in three Naryn villages: Eki-Naryn, Dobolu and Oruktam. Participatory knowledge co-creation by the local stakeholders and professional scientists was the core assumption of the project's rationale. Apart from attending training sessions and workshops, the community members also actively participated in environmental monitoring of their mountain ecosystem, tracking rainfall, testing ground temperatures, and measuring wind power. Technology transfer that enabled these activities was a core component of the project, including: (1) weather monitoring stations, equipped with rain gauges, (2) smartphones with a CyberTracker App and (3) wildlife monitoring camera traps. MSRI identified five key stakeholder groups: school personnel, village leaders, herders, park rangers, and park authorities; all of which became the project partners. As partners, these actors were also intended to ensure continuation of the monitoring activities after the program's official closure.

The weather stations were installed in the vicinity of village schools and laptop computers were gifted to the faculty to allow for visualising monitoring data from the stations (mainly temperature and precipitation). Village leaders also participated in the weather station maintenance training; they were taught to read the logger and to interpret the results to be able to facilitate information dissemination in the villages.

The CyberTracker app is a GPS-based software that allows observers to communicate their wildlife observations with high accuracy through a smartphone device. Smartphones equipped with the app were gifted to herder families headed for the highland summer pastures: they were to help them map out places of exceptional biodiversity, habitats of endangered species and points of interest for prospective eco-tourists. Smartphones with the app were also given to the national park rangers, to use on their regular field patrols: recording sign of animal presence in the vast Naryn

Table 1. M-EVO project stakeholder groups and corresponding technological objects.

Technical development objects of the EVO project	Stakeholder group involved
Weather monitoring stations and laptop computers	Village school staff Village leaders
Smartphones with CyberTracker App	Herders National park rangers
Wildlife monitoring camera traps	Park authorities

Table 2. Overview of informants.

Stakeholder groups	Location	No of informants
Naryn Natural Reserve: leaders and representatives	Naryn	3
Salkyntor National Park: leaders and representatives	Naryn	3
Local schools (elementary): teachers and headmasters	Dobolu, Eki-Naryn	9
Village leaders (and former leaders)	Dobulu	2
Water Committee representatives	Eki-Naryn	4
Pasture Committees representatives	Dobolu and Eki-Naryn	2
Herders' representatives	Tash-Bashat, Eki-Naryn	2
EVO researchers and implementers	Bishkek (via Skype)	5

forests and mountain landscapes. Finally, the Salkyn-Tor and Naryn park authorities (branch officers in Naryn) received camera traps: remotely activated cameras, equipped with a motion sensor or an infrared sensor, used for wildlife monitoring (Table 1).

Methods

The research for this paper was conducted during the project closing stage: first, at the point of equipment transfer, and then again at the project's closing meeting (attended by all the stakeholders that took part in the project).

The methods comprised unstructured individual and group interviewing (with translator) with representatives of all the stakeholder groups (school personnel, village leaders, herders, park rangers, and park authorities). We selected our interviewees through purposive sampling (via talking to the most engaged stakeholder representatives) followed by convenience sampling (conversations with stakeholders who were present at the notice board installations and who attended the project's closing meeting). We also applied ethnographic observation (attending the project activities' and closing meetings, thick description). All interviews were conducted in situ; they were informal and resembled relaxed conversations. The questions included casual inquiries about the project experience and the informants' perceptions concerning the future of the project, as well as observations and informal interaction. Some of the interviews and the discussions held at the project's meeting were recorded; we also took detailed notes, including several verbatim transcriptions of insightful quotes and issues of special importance to the informants. Some of the interviews with the M-EVO project researchers were performed via Skype in the months following fieldwork. The table below presents an overview of the 29 individual informants (Table 2).

Results: recounting M-EVO project experience

All of our informants were very positive recounting their experience of the M-EVO project. Interest in the natural environment and the chance to work with new technologies were the most mentioned benefits of participating people.

A number of informants were keenly interested in the project technologies and expressed their eagerness to 'continue with the project' after the official closure. As one of the park authorities mentioned: 'if ever I lay my hands on any grant money, this is what I am going to do with it: I will buy more of these devices (smartphones with CyberTracker). They are so much better than the

journals² (normally, all of the rangers hand-write detailed reports of their patrols, which are then catalogued and archived). One interviewee further commented, ‘they are faster for sure, and with more detailed information. This has also motivated my rangers a lot, working with such a device.’ One of the herders commented: ‘We became more attentive to what surrounds us. To our surprise, we found how much we missed! Springs, medicinal herbs, berries, weed plants on pastures [plants not edible by livestock] – all this information, stored in this phone, this could be very useful for many different people.’³ These and similar statements can be read as a testimony that the M-EVO project rationale was well-aligned to the local needs and preferences.⁴ At the same time, post-ANT researchers observe that the processes through which actors relate to one another are both power-laden and dynamic: actors are not the same from situation to situation but are transformed in their movement between practices (Gad & Jensen, 2010). In this context, the pre-closure and post-closure networks can be seen as manifestations of their changing identities in both economic and political terms.

Weather stations

The weather stations were gifted to the local school teachers and headmasters who were to visualize data and distribute them among the community members. The resulting temperature and precipitation data was meant to guide ‘more sustainable livelihoods’ of the farming communities.

As it turned out, weather monitoring had little relevance for the farmers who were interested primarily in weather forecasting (prediction). At the same time, the school staff found the weather stations to be extremely useful in their teaching. New technology proved to be a big attractor for the children, who volunteered to assist with the data logger readings and expressed new interest in physical sciences. Building on this momentum, MSRI researchers partnered up with a local NGO, Camp Alatoo, and designed a citizen-science project for children using the Lapis Guides digital field guide app, which reportedly proved very popular among the schools in the region (Rosset, Ibraimova, Kapalova, Isakov, & Azhibekov, 2018).

The village leaders appreciated the potential of having monitoring data of scientific quality which they intended to use to pressure the local governments. According to the current regulation in Kyrgyzstan, if the temperature falls below minus 36 Celsius degrees in winter, or plus 36 in the summer, the farming communities are entitled to a heating and water subsidy, respectively. Since temperatures in the mountains vary widely even within one locality, the village leaders were never able to prove that the extreme weather condition occurred, since the nearest government monitoring station is downvalley in Kochkor. With the monitoring data, the village leaders believed they would be able to obtain their subsidy. In addition, acknowledging the importance of weather information, the village leaders reached out to the mobile company MegaCom. Through a personal connection, they were hoping to potentially involve the mobile operator in disseminating the weather forecast to farmers via short messages, as a corporate social responsibility project. Such uses of the weather monitoring, thought consistent with the M-EVO’s objectives of improved ecosystem knowledge and adaptive governance, were never intended by the project. At the same time, it appears that the very presence of the weather stations in the project localities triggered unforeseen, but potentially very useful, civic initiatives.

Smartphones and CyberTracker

The two stakeholder groups that were working with smartphones and the CyberTracer application (herders and park rangers) were very keen to incorporate the devices in their future activities.⁵ At the same time, even though they considered mapping out the ecosystem (with GPS-referenced places of rare fauna and flora, sightings of endangered species) as a relevant and useful exercise, in the future they mainly wished to use the devices to monitor the populations of wolves in Naryn.

While the park rangers were eager to use the mapped data to demonstrate the scale of the wolf problem to the local authorities, the herders and the farmers were interested in the potential of CyberTracker to track the wolves they believed to endanger their livestock.

As it turns out, wolves are a primary concern for the mountain populations of Naryn. They are not a protected species in Kyrgyzstan and their estimated population is three times that of the neighbouring Kazakhstan, whose territory is almost five times larger. There is no state compensation for damages inflicted by wolf attacks on herds, and attacks on people are considered a frequent threat in wintertime (Lescureux & Linnell, 2013). Against this background, the planned use of the M-EVO technology to control the wolves' population and to appeal to authorities to take action is certainly understandable. At the same time, such use of the project equipment can be perceived as contradictory to the original logic of a conservation-oriented project.

Camera traps

The national park authorities who were managing the motion-activated camera traps intended to continue their activities as outlined by the project (environmental monitoring of the Naryn mountain ecosystems). At the same time, the park staff decided to take the project one step further: in order to make benefits of wildlife monitoring more tangible to local stakeholders, they decided to use the cameras to attract a new donor to the area. One of our respondents had a personal connection with a large German conservation NGO, NABU (Nature and Biodiversity Conservation Union). The main objective of NABU's presence in Kyrgyzstan is to protect the snow leopard: a rare and highly endangered species in the Tian Shan Mountains in Kyrgyzstan:

If we capture a picture of this leopard here, and they go out only at night, so you need to take such a picture with a motion camera, then NABU is going to dispatch a large project here in Naryn! This would be very beneficial for us, as they always work with the local people. So now, we are all about getting this picture! One picture of this cat, and NABU should come to Naryn.⁶

Though used in line with the M-EVO project rationale (conservation), the camera trap becomes a more nuanced tool: its function is to attract more external funding to the resource constrained park authorities. In addition, some of our informants in the villages saw the potential of shifting the use of camera traps from monitoring wildlife to detecting poachers. According to them, the very knowledge that the motion cameras are hidden in the forests of Naryn effectively deterred most potential poachers. Yet again, though used in accordance with the logic of conservation, the cameras are used in a way different from initially intended.

To sum up: even though the stakeholder representatives agreed with the M-EVO project's rationale and general objectives, when confronted with the long-term time horizon they identified more pressing problems and an array of 'better uses' for the project equipment. While some of these initiatives have the potential to continue or even deepen the impacts of the planned interventions, others take a different pathway, and some – like the wolf-tracking endeavour – overturn the project logic altogether. At the same time, all of the stakeholder groups were committed to 'continue,' which, arguably, is the indicator of a 'sustainable' project.

Analysis

When the M-EVO project started in Naryn, it was the researchers who selected the different stakeholder groups as project partners and matched them with the respective technological objects. This was based on a comprehensive problem analysis performed by MSRI with the intention to best integrate the technical objects in the personal (livelihoods) and professional (operational capacity) lives of the partners. In ANT terminology, we would say that the researchers constructed a network with themselves at its centre (Figure 1). Guided by other scientific artefacts (academic literature,

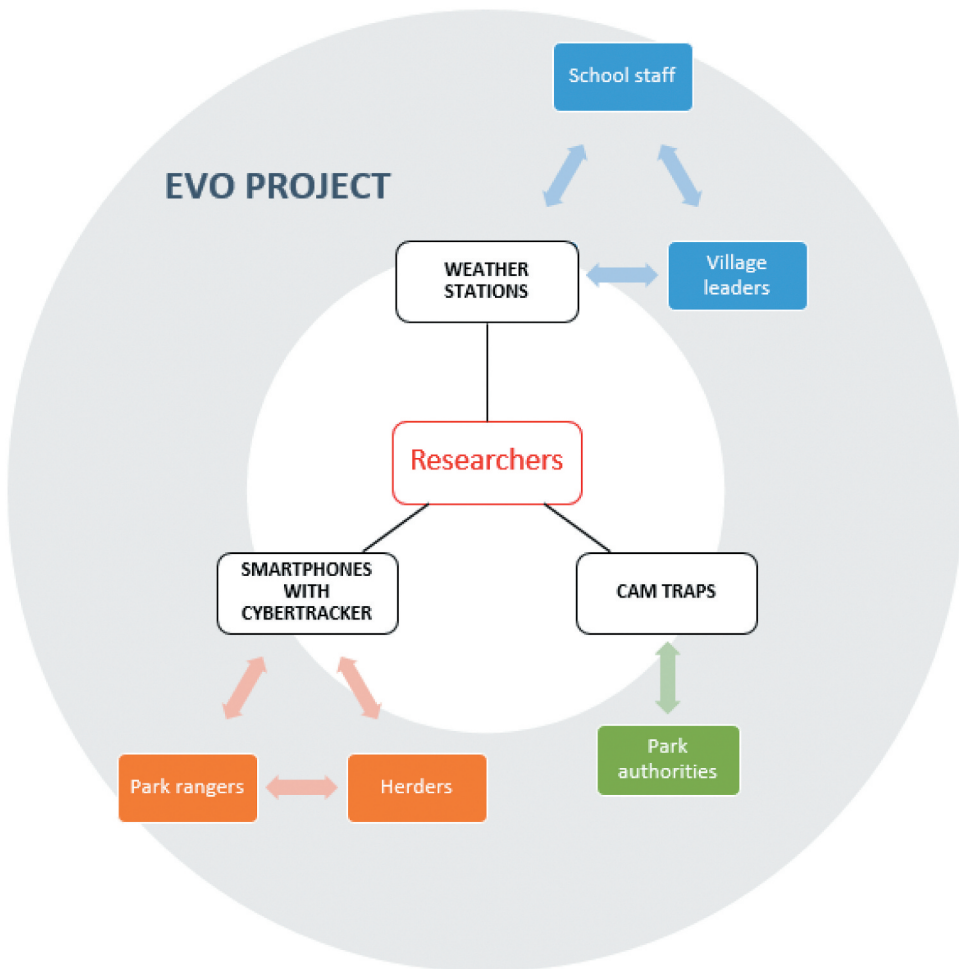


Figure 1. The initial set-up of the M-EVO project's network.

available socio-economic data about the region and previous experience) they defined the interests and identities of this network's actors, as well as the relationships between them. In other words, they performed a translation (Callon, 1986).

It is important to observe that the translation was successful: for as long as the project continued, all of the actors performed their functions, and were pleased with the results. The scientific interpretation of the 'problem' and the 'needs' of the human and the non-human actors in Naryn held the network together for as long as the researchers remained in control. However, a network is never static: actor are constantly reinterpreting, displacing and re-establishing the relationships that define them (Law & Callon, 1992). For this reason, the moment of project closure is marked by another translation. As the original project network ceases to exist, the relations between actors also shift, and the principal actors (researchers) withdraw their control and physical presence from Naryn. ANT specifies that network transitions can often be contested, ambiguous and problematic (Heeks & Stanforth, 2015). In the case of the M-EVO project, two crucial processes were set in motion.

First, some of the actors-objects change their identity and/or function. For example, within the M-EVO network, the weather stations were meant to generate actionable knowledge for adaptive livelihoods. After the project closure, their physical attributes remained the same: they are machines

producing data about precipitation. This data, however, is not used by livestock-owners – who prefer to rely on forecasts – but by the school personnel (function: educational programs for children) and village leaders (function: obtaining heat/water subsidies). The case of smartphones with Cyber Tracker App and herders is even more illustrative: from a tool of biodiversity conservation, the technology is to become a tool of wildlife tracking to resolve a human-wildlife conflict.

Second, the project network, previously held together through workshops, meetings and trainings organized by the researchers, disintegrates and, as a result, new networks are formed. These are based on new, translated functionalities of development objects, a process that Law (1987) describes as ‘system building.’ Other than being financed and maintained by the researchers on the project, the weather stations, the smartphones with CyberTracker, and the camera traps, had little in common. Though all three generally served conservation purposes, within the project they were used independently: each generated specific outputs under the general umbrella of ‘conservation’ and ‘adaptive livelihoods.’ These were the precipitation data logs for the weather stations, the GPS-referenced maps of Naryn’s pastures for the smartphones, and the wildlife photo records for the camera traps. As a result of the project network restructuring, new relationships were formed: e.g. the ‘weather station – farmers’ relationship disintegrates while the new relationship, ‘weather stations – government officials,’ is formed (Figure 2). These are also accompanied by the change in function (role in the network): formerly tools for adaptive livelihoods/environmental conservation, the three technologies now have the power to accredit and legitimize (e.g. pressuring government officials), to command and control (e.g. the wolf populations), and to attract new actors into the network(s) (NABU, Camp Alatoo, the poachers).

Technology and translation

As is the case with many development projects, M-EVO entails a transfer of powerful objects: machines that allow users to describe, capture, and analyse the environment with scientific precision and authority. In themselves, the inner properties of these machines do not count: as ‘they are mere receptacles for human categories,’ in this case representing legitimacy, validity, truth and power (Latour, 1991, p. 52). While as receivers of such ‘development gifts’ (Stirrat & Henkel, 1997) our actors are bound by the reciprocal relationship with the researchers and donors, this relationship ends with the project closure. Released from the constructed reality of the project, the local stakeholders generate and join new networks and interact with new actors that the project’s construction did not directly consider (e.g. ‘multiple ontologies’). A powerful translation takes place, with some actors (e.g. herders) reinterpreting or redefining the identities and functionalities of other actors (e.g. Cyber Tracker), to align those actors’ interests with their own Law & Callon, 1992).

Importantly, not all of the old network identities and relationships, and functions, irrevocably cease to exist. For example, the camera traps remain powerful objects-actors in wildlife monitoring; they also deter poachers, which serves environmental conservation. At the same time, they are now also to be used to attract new actors into the network (e.g. NABU), which in turn will affect other actors (e.g. park authorities, community members) by generating new project realities, and new project networks. As many development objects, the M-EVO technologies were a part of a web of socio-material relations, and they remain in use precisely because of the multiplicity of these relations and the many different functions they can perform within them (de Laet & Mol, 2000). Within ANT, it is not clear when development objects succeed or fail, when they achieve their aims and when they falter. For this reason, judging whether or not the object fulfilled its mission (‘project successes’) is not a binary matter. M-EVO technology may now work for the benefit of rural livelihoods, yet not bring about conservation. It may also empower local actors even if it does not diminish their dependence on development aid (Redfield, 2016). What is more, the post-project networks are also a result of a power-laden negotiation between all the

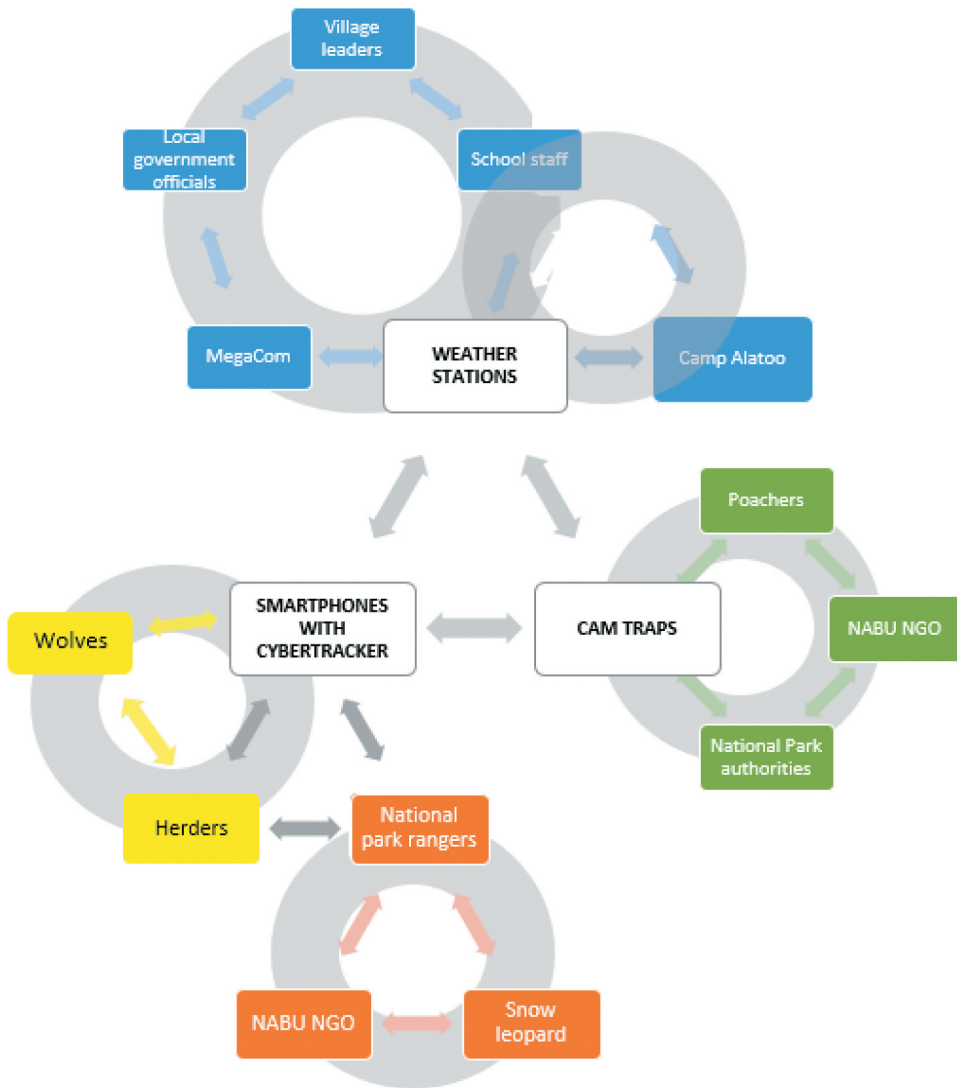


Figure 2. The anticipated project networks after the project's closure.

remaining actors-objects both between and within the remaining actors (i.e. bearing in mind that actors are also networks: e.g. within the actor-network of 'herders' not all of the community members might have opted for the new application – functionality of the Cyber Tracker etc.).

Development projects very rarely consider such duality of function and rates of success. Within the sector, 'managing for impact' often imposes a pre-defined project trajectory and irrevocably reduces complex social reality to a clear-cut (but artificially diminished) range of project deliverables. In ANT terms, projects are tight networks, with precisely described functions, to the extent that they are often seen as a singular entity. In the next section, we use the ANT concept of a 'black box' to illustrate how projects define networks, constrain actors and impose relationships of power.

The project black box

In many ways, development projects are perfect examples of black boxes: management constructs that have dominated the industry through their efficiency. As Krause (2014) states, ‘To understand the practices of (development) we need to understand that development is a form of production and has one primary output, or product: which is the project. Managers produce projects and strive to make good projects’ (p. 4). According to Latour, a black box, like any network, is created through acts of translation. The actors, however, need to be kept in check, as ‘the assembly of people necessary to turn a claim into a black box will behave unpredictably: they will dissent, they will open it, tinker with it; worse, they will lose interest and drop it altogether’ (Latour, 1987, p. 122). For this reason, despite declarations of being stakeholder-driven, participatory, ‘flat’ and flexible, projects are always hierarchical, as it is the hierarchies that stabilize the network. In a comprehensive literature review, Eskerod and Huemann (2013) reveal that project ownership by stakeholders nearly always remains superficial: ‘the current project stakeholder practices represent mainly a management-of-stakeholders approach i.e. making stakeholders comply to project needs’ (2013, p. 36).

ANT perspective allows us to open the ‘black box’ of a ‘development project’ (such as M-EVO) and to investigate the dynamics of its process. Each ‘black-boxed’ project represents a stabilized network whose inner workings are obscured from view. By scrutinizing how the actors and relationships in these networks evolve in time (including local stakeholders and donors, funding, activities, protocols, outputs and procedures) we can shed some light on the problem of sustainability in development projects, and scrutinize it as inherently political. The same project may be both participatory and autocratic in ANT sociological ontology: an ontology that is fluid and consequently also multiple. What the technological objects represent to other actors is determined by their unique reality, ‘yet, if ontology is social, and thus multiple, then it is also ultimately political’ (Carolan, 2004, p. 497; Mol, 1999).

Revisiting project sustainability

Desired by all but achieved by few, project sustainability can be seen as a harmful and constraining ‘doctrine’ (Swidler & Watkins, 2009) and a ‘struggle’ (Mog, 2004) that, at times, unnecessarily hampers development efforts. As observed by Stirrat and Henkel (1997), extending the longevity of development projects implies extending the period of the reciprocal donor – beneficiary relation, as the act of receiving is hedged with conditionality. In ANT terms, by requiring a long term relationship, former actors force their way back into a network they are no longer part of. Against this background, we argue that the sustainability doctrine fails to recognize the development receivers as able and independent actors whose realities, as well as values and preferences, may shift in time. By extending the accountability period beyond the specific time horizon, ‘sustainable’ projects allow the development enterprise to reinforce the system of authority and control, albeit partially concealed by the rhetoric of participation and partnership. Ascribing fixed functionalities to development objects freezes the network in a situational permanence. Contrarily, as illustrated by our M-EVO case study, the actors-objects need to maintain their fluidity (de Laet & Mol, 2000) and to be ‘topologically multiple’ in order to allow the networks to evolve and change (Law, 2002, p. 102).

Against this background, we argue for a much more nuanced approach to project sustainability. As illustrated by the case-study, the M-EVO project has both ceased to exist and exists forever, as it has achieved perfect sustainability and also no sustainability at all. In order to translate this finding into practice, we propose broadening the meaning of sustainability beyond mere ‘continuation.’ We propose three – at times overlapping – dimensions of project sustainability (Table 3).

Looking back at our data, we can categorize the newly planned (post-project) actions of the key stakeholder groups according to the three dimensions of sustainability, as presented in Table 4.

Table 3. Dimensions of project sustainability.

Sustainability dimension	Guiding question
Dimension I Continuation of project's activities	To what extent is it attainable for the project to continue the delivery of the services to target stakeholders?
Dimension II Durability of the changes achieved by the project	To what extent can the positive changes already achieved by the project be sustained over time?
Dimension III Feasibility of independent growth	What is the capacity of the local actors and structures to further develop/deepen the impacts that the project has managed to attain? and/or to adapt tools or results to novel development purposes?

Table 4. M-EVO project continuation and the three dimensions of sustainability.

	Project continuation initiatives	Technology involved	Sustainability dimension
Citizen initiative	Integrating weather stations in school curricula	Weather stations	Dimension I Continuation of delivery of project's goods and services
	Reaching out to NABU/finding snow leopard	Cam traps	Dimension II Durability of the changes achieved by the project
	Mapping wolf sign and attacks to mitigate HWC, possibly to control their population	Smartphones	Dimension III Feasibility of independent growth
	Detecting poaching	Cam traps	Dimension III Feasibility of independent growth
Policy influence (local governance)	Extreme weather subsidy	Weather stations	Dimension II Durability of the changes achieved by the project
	Mapping wolf movements and attacks, to demonstrate the scale of the problem	Smartphones	Dimension III Feasibility of independent growth
Private sector partnership	Mega-Com CSR partnership	Smartphones	Dimension III Feasibility of independent growth

Importantly, scoring negatively in any of the three dimensions does not necessarily imply the overall program has been a failure: local conditions, lack of resources, or competing demands might simply steer the intervention in an entirely different direction (Wiltsey Stirman et al., 2012). Regardless of the results of the initial impact assessment, the project's continuation does not necessarily advance as originally intended. Wiltsey Stirman et al. argue that:

discontinuation of a particular intervention may be the result of development or discovery of more effective, efficient, or compatible practices. Adaptations, partial continuation of a program or intervention, or integration of new practices may occur in response to new evidence, changes in priorities or resource availability, or other contextual influences' and they might in fact be 'at odds' with the original goals and intentions of the host systems or organizations (Wiltsey et al., 2012, p. 2).

Adopting a more nuanced approach to project sustainability will allow development theorists and practitioners to fully recognize the agency of other actors and to question the constraining duality of project success and failure. It is also in line with some of the post-ANT critiques that warn against the instrumentalist, 'managerial' applications of ANT that focus on privileged actors (both human and non-human) as means of 'figuring out' the way of creating the most stable networks (Gad & Jensen, 2010). Such applications neglect the fact that networks appear quite differently for marginalized actors to whom post-ANT awards special attention (Haraway, 1997; Star, 1991).

Discussion: actor-network theory in development studies

Through this paper, we show that many concepts of ANT can be illuminating to dismantle the inner workings of the development sector, especially in contexts where technology and power relations overlap. ANT exposes the way in which networks are fundamental to development but are also in constant motion (Heeks & Dev, 2013). This was well illustrated by our case study, where actors-objects coalesced into new networks around the technical objects, reconfigured existing networks and generated new relationships, often attracting new actors and shifting the relations of power. These insights guided us in our thinking about what is understood as project sustainability. A project that simply continues its operations after its official closure can be considered sustainable only as long as its network is maintained and keeps functioning within the designed structure. This is rarely the case: with the withdrawal of one actor (here, researchers, implementers and donors), the project network is irreversibly distorted, actors acquire new roles and functions and the relationships between them are changed. For this reason, deepening the project impacts (e.g. adding new activities, services, stakeholders) or shifting its course (e.g. through flexible use of technology) should also be considered as manifestations of 'project sustainability.' Adopting a broader approach to project sustainability can thus help us restructure our thinking about engaging with local stakeholders in a meaningful and equitable way.

While the reflections and conclusions we draw with regards to project sustainability certainly extend beyond our applied case, the mechanisms that we observe within and between the specific M-EVO actors-networks do not. As a case of applied micro-ethnography, our analysis of the M-EVO project is intrinsically tied to political ontologies that we exhibit as researchers. As an interpretive method, ANT aims at multiplying the possible interpretations of the snapshots of social realities captured in our data as opposed to reducing them to a value-laden truth judgment as required by the 'generalizability' clause. However, this is precisely why ANT provides such a useful lens to study development today: with singular, positivistic interpretations of digitization and datafication making fast advances in Africa and Asia, and often evading critical scrutiny (Mann, 2018). ANT's deferential treatment of both human and non-human actors evades claims of either technological or social determinism; it is both irreductionist and anti-deterministic and as such, extremely well suited to illuminate the complex processes of development (Heeks & Dev, 2013).

Conclusion

Our analysis of the M-EVO conservation project in Naryn revealed that while the intervention is likely to continue beyond its timeframe, the local stakeholders adapt its logic, artefacts, objects and tools to what they deem appropriate, timely and necessary. We conclude that while the sustainability imperative may provide a useful formulation of a long-term commitment of development actors, it also carries with it the false promise of a situational permanence while social realities shift and vital interests may conflict. As elaborated by Foggin, Brombal, and Razmkhah (2021), 'the essence of transformations necessary for effective and lasting change are . . . convivial solutions (or "living with others"), in which relationality and an appreciation of our interdependencies are central.'

Here, we used the case study of the M-EVO project to consider actors, networks and relationships in a development project, and through these to critically assess the sustainability doctrine that has established its hegemony in development theory and practice. We described how the ability of an intervention to perpetuate itself without outside help has become the hallmark of project success. We argue that although a long-term perspective is undeniably useful, extending a project's lifetime should not be the sole criterion for marking interventions as 'successful.' Against this background, actor-network theory provides us with an illuminating analytical lens to scrutinize the role of development objects in establishing, maintaining and disrupting relations of power. Through a series of 'translations,' technological objects can both facilitate and hamper network construction,

depending on the differences in problem framing and corresponding priorities of the stakeholders. While a successful translation maintains the integrity of development projects, it may also obscure power relations from view: unquestioned, the ‘black boxes’ of projects are laden with the interests and values of the donor and implementers.

In terms of implications for development theory and practice, we argue for multi-purpose, multi-stakeholder projects to avoid binary evaluation: since their functionalities are not clear-cut, neither is their threshold for success. Furthermore, equating project sustainability with project success is both limiting and misleading: adaptations, partial continuation or discontinuation of project activities may occur in response to new evidence, new tools and changing priorities. Ceasing authority with regards to the future course of an intervention does not need to imply failure, nor does it lead to decreased accountability and transparency. ‘Sometimes abandoning control may contribute to spreading what one has been making’ (de Laet & Mol, 2000, p. 250).

Notes

1. The M-EVO project was developed in four mountain sites: Peru, Ethiopia, Nepal and Kyrgyzstan. In this paper, we focus on the Kyrgyz site only.
2. Individual interview, National Park representative, Naryn, April 2017.
3. Individual interview, herder representative, Naryn, April 2017.
4. As a proof-of-concept project, M-EVO did not have a pre-designed monitoring and evaluation strategy. This study can be seen as a special case of a post-project evaluation (see Myers et al., 2014).
5. At the time when this research was conducted, the herders temporarily returned their smartphone devices to MSRI for necessary maintenance.
6. Individual interview, community leader, Eki-Naryn, April 2017.

Acknowledgments

This paper was realized within the interdisciplinary interuniversity consortium M-EVO. The authors acknowledge the financial support of the Ecosystem Services for Poverty Alleviation Programme, UK-ESPA (grant number NE-K010239-1).

The fieldwork for this paper was made possible thanks to the cooperation between Wageningen University and Mountain Societies Research Institute of the University of Central Asia (UCA). The authors are indebted to the MSRI team of researchers who made this data collection possible by sharing their insights and facilitating the cooperation with the communities in Naryn, in particular, to Altyn Kapalova, Azamat Azarov and Christian Hergarten. Last but not least, this research would not have been possible without the assistance of the field expert, translator and coordinator, Samat Kalmuratov, to whom the authors extend their warmest gratitude. We also wish to extend our thanks to Camp Alatoo Kyrgyzstan for all their insights concerning the management of community-based ecosystem projects.

Disclosure statement

No potential conflict of interest was reported by the author(s)

Funding

This work was supported by the Ecosystem Services for Poverty Alleviation (UK-ESPA) [NE-K010239-1].

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References

- Agadjanian, V., & Gorina, E. (2019). Economic swings, political instability and migration in Kyrgyzstan. *European Journal of Population*, 35(2), 285–304.
- Ahmad, S. M., & Talib, N. B. A. (2010). Improvement of project sustainability by community participation: A case of Abbottabad District in Pakistan. *African Journal of Business Management*, 4(17), 3761–3768.
- Appadurai, A. (1986). Introduction: Commodities and the politics of value. In A. Appadurai (Ed.), *The social life of things: Commodities in cultural perspective* (pp. 3–63). Cambridge: Cambridge University Press.
- Avgerou, C., & Walsham, G. (2000). In C. Avgerou, and G. Walsham (Eds.), *Information technology in context: Studies from the perspective of developing countries* (pp.). University of North London voices in development management. Ashgate Publishing, London, UK.
- Birke, F. M., & Knierim, A. (2020). ICT for agriculture extension: Actor network theory for understanding the establishment of agricultural knowledge centers in South Wollo, Ethiopia. *Information Technology for Development*, 26(3), 591–606.
- Callon, M. (1986). Some Elements of a sociology of translation: Domestication of the scallops and the fishermen of st brieuc bay. In J. Law (Ed.), *Power, action and belief: A new sociology of knowledge?* (pp. 196–223). London and Boston: Routledge.
- Carolan, M. S. (2004). Ontological politics: Mapping a complex environmental problem. *Environmental Values*, 13(4), 497–522.
- Cassidy, E. F., Leviton, L. C., & Hunter, D. E. K. (2006). The relationships of program and organizational capacity to program sustainability: What helps programs survive? *Evaluation and Program Planning*, 29(2), 149–152.
- Cavalheiro, G., & Joia, L. (2016). Examining the implementation of a European patent management system in Brazil from an actor-network theory perspective. *Information Technology for Development*, 22(2), 220–241.
- Cordella, A., & Hesse, J. (2014). E-government in the making: An actor network perspective. *Transforming Government: People, Process and Policy*, 8(2), 283–308.
- Crewett, W. (2012). Improving the sustainability of pasture use in Kyrgyzstan. *Mountain Research and Development*, 32(3), 267–274.
- de Laet, M., & Mol, A. (2000). The Zimbabwe bush pump: Mechanics of a fluid technology. *Social Studies of Science*, 30(2), 225–263.
- Dedeke, A. N. (2017). Creating sustainable tourism ventures in protected areas: An actor-network theory analysis. *Tourism Management*, 61, 161–172.
- Diaz Andrade, A., & Urquhart, C. (2010). The affordances of actor network theory in ICT for development research. *Information Technology and People*, 23(4), 352–374.
- Dörre, & Schütte, S. (2018). *Potential and challenges for development in Naryn Kryrgyzstan*. Berlin Geographical Papers (38). Centre for Development Studies, Freie Universität Berlin.
- Elbanna, A. (2011). The theoretical and analytical inclusion of actor network theory and its implication on ICT research. In A. Tatnall (Ed.), *Actor-network theory and technology innovation* (pp. 130–142). Hershey, New York: Information Science Reference.
- Eskerod, P., & Huemann, M. (2013). Sustainable development and project stakeholder management: What standards say? *International Journal of Managing Projects in Business*, 6(1), 36–50.
- Foggin, J. M., Brombal, D., & Razmkhah, A. (2021). Thinking like a mountain: Exploring the potential of relational approaches for transformative nature conservation. *Sustainability*, 13(22), 12884.
- Fu, X., Pietrobelli, C., & Soete, L. (2011). The role of foreign technology and indigenous innovation in the emerging economies: Technological change and catching-up. *World Development*, 39(7), 1204–1212.
- Gad, C., & Jensen, C. B. (2010). On the consequences of post-ANT. *Science, Technology, & Human Values*, 35(1), 55–80.

- Haraway, D. (1997). Mice into wormholes: A comment on the nature of no nature. In G. L. Downey & J. Dumit (Eds.), *Cyborgs and citadels: Anthropological interventions into emerging sciences and technologies* (pp. 209–243). Santa Fe, NM: School of American Research.
- Heeks, R., & Dev. (2013). *Development studies research and actor-network theory. Actor-network theory for development* Accessed 12 September 2021 (Working Paper 1). Working Paper 1) <https://ssrn.com/abstract=3540083>
- Heeks, R., & Stanforth, C. (2015). Technological change in developing countries: Opening the black box of process using actor-network theory. *Development Studies Research*, 2(1), 33–50.
- Karpouzoglou, T., Dewulf, A., Perez, K., Gurung, P., Regmi, S., Isaeva, A., . . . Cieslik, K. (2020). From present to future development pathways in fragile mountain landscapes. *Environmental Science and Policy*, 114, 606–613.
- Karpouzoglou, T., Zulkafli, Z., Grainger, S., Dewulf, A., Buytaert, W., & Hannah, D. M. (2016). Environmental Virtual Observatories (EVOs): Prospects for knowledge co-creation and resilience in the information age. *Current Opinion in Environmental Sustainability*, 18, 40–48.
- Kasymov, U., & Thiel, A. (2019). Understanding the role of power in changes to pastoral institutions in Kyrgyzstan. *International Journal of the Commons*, 13(2), 931–948.
- Krause, M. (2014). *The good project: Humanitarian relief NGOs and the Fragmentation of reason*. University of Chicago Press.
- Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Cambridge: Harvard University Press.
- Latour, B. (1991). *We have never been modern*. Cambridge, Mass: Harvard University Press.
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network theory*. New York: Oxford University Press.
- Law, J. (1987). On the social explanation of technical change: The case of the portuguese maritime expansion. *Technology and Culture*, 28(2), 227–252.
- Law, J. (2002). Objects and spaces. *Theory. Culture and Society*, 19(5–6 91–105).
- Law, J., & Callon, M. (1992). The life and death of an aircraft: A network analysis of technical change. In W. E. Bijker, and J. Law (Eds.), *Shaping technology – Building society: Studies in sociotechnical change* (pp. 21–52). Cambridge, Mass: MIT Press.
- Lescureux, N., & Linnell, D. J. C. (2013). The effect of rapid social changes during post-communist transition on perceptions of the human - wolf relationships in Macedonia and Kyrgyzstan. *Pastoralism*, 3(1), 1–20.
- Levine, J., Isaeva, A., Zerriffi, H., Eddy, I. M. S., Foggin, M., Gergel, S. E., & Hagerman, S. M. (2019). Testing for consensus on Kyrgyz rangelands: Local perceptions in Naryn Oblast. *Ecology and Society*, 24(4), 36.
- Lewis, D., & Mosse, D. (2006). Bloomfield, CT: Development Brokers and Translators. Kumarian Press.
- Lungo, M. P., Mavole, J., & Martin, O. (2017). Determinants of project sustainability beyond donor support: Case of caritas Norway supported governance project in mansa diocese, Zambia. *Arts and Social Sciences Journal*, 8(3). doi:10.4172/2151-6200.1000278
- Mann, L. (2018). Left to other peoples' devices? A political economy perspective on the big data revolution in development. *Development and Change*, 49(1), 3–36.
- Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W., III (1972). *The limits to growth; A report for the club of rome's project on the predicament of mankind*. Universe Books.
- Mestre, I. (2019, 26). The way to the pastures: How to reconcile community-based pasture management with mobility in agro-pastoral systems in the Naryn province of Kyrgyzstan. *Ager*, 2019, 151–187.
- Michael, M. (2017). *Actor-Network Theory: Trials, Trails and Translations*. London: Sage.
- Mog, J. M. (2004). Struggling with sustainability - A comparative framework for evaluating sustainable development programs. *World Development*, 32(12), 2139–2160.
- Mol, A. (1999). Ontological politics. A word and some questions. *The Sociological Review*, 47(1), 74–89.
- Myers, B., Fisher, R., Pickering, S., & Garnett, S. (2014). Post-project evaluation of the sustainability of development project outcomes: A case study in eastern Indonesia. *Development in Practice*, 24(3), 379–389.
- OECD (2019). *Better Criteria for Better Evaluation* Accessed 21 October 2021. Form www.oecd.org/dac/evaluation.
- OECD (n.d.). *Paris Declaration and Accra Agenda for Action* Accessed 21 October 2021. From <https://www.oecd.org/dac/effectiveness/parisdeclarationandaccraagendaforaction.htm>
- Pade, C., Mallinson, B., & Sewry, D. (2008). an elaboration of critical success factors for rural ICT project sustainability in developing countries: Exploring the DWESA case. *Journal of Information Technology Case and Application Research*, 10(4), 32–55.
- Pansera, M., & Martinez, F. (2017). Innovation for development and poverty reduction: An integrative literature review. *Journal of Management Development*, 36(1), 2–13.
- Penteado, I. M., Do Nascimento, A. C. S., Corrêa, D., Moura, E. A. F., Zilles, R., Gomes, M. C. R. L., . . . Pacifico, A. C. N. (2019). Among people and artifacts: Actor-network theory and the adoption of solar ice machines in the Brazilian Amazon. *Energy Research and Social Science*, 53, 1–9.
- Rasouli, A. H., & Kumarasuriyar, D. A. (2016). The social dimension of sustainability: Towards some definitions and analysis. *Journal of Social Science for Policy Implications*, 4(2), 23–34.

- Redfield, P. (2016). Fluid technologies: The bush pump, the LifeStraw[®] and microworlds of humanitarian design. *Social Studies of Science*, 46(2), 159–183.
- Rhodes, J. (2009). Using actor-network theory to trace an ICT (telecenter) implementation trajectory in an African women's micro-enterprise development organization. *Information Technology and International Development*, 5(3), 1–20.
- Rosset, A., Ibraimova, A., Kapalova, A., Isakov, A., & Azhibekov, B. (2018). Citizen science comes to school: Kyrgyz students protect their local water resources. In J. Xu (Ed.), *Mountain Futures: Innovation and inspiration from the world's highlands* (pp. 117–122). World Agroforestry Centre. Available at <https://www.worldagroforestry.org/publication/mountain-futures-inspiration-and-innovation-worlds-highlands>
- Sagynbekova, L. (2017). Environment, rural livelihoods, and labor migration: A case study in central Kyrgyzstan. *Mountain Research and Development*, 37(4), 456–463.
- Shigaeva, J., Hagerman, S., Zerriffi, H., Hergarten, C., Isaeva, A., Mamadalieva, Z., & Foggin, M. (2016). Decentralizing governance of agro-pastoral systems in Kyrgyzstan: An assessment of recent pasture reforms. *Mountain Research and Development*, 36(1), 91–101.
- Silvius, A. J. G., Kampinga, M., Paniagua, S., & Mooi, H. (2017). Considering sustainability in project management decision making: An investigation using Q-methodology. *International Journal of Project Management*, 35(6), 1133–1150.
- Sparks, J., & Rutkowski, D. (2016). Exploring project sustainability: Using a multiperspectival, multidimensional approach to frame inquiry. *Development in Practice*, 26(3), 308–320.
- Stanforth, C. (2007). Using actor-network theory to analyze E-government implementation in developing countries. *Information Technologies and International Development*, 3(3), 35–60.
- Star, S. L. (1991). Power, technologies and the phenomenology of conventions: On being allergic to onions. In J. Law (Ed.), *A sociology of monsters: Essays on power, technology and domination* (pp. 26–56). London and New York: Routledge.
- Steimann, B. (2012). Conflicting strategies for contested resources: Pastoralists' responses to uncertainty in post-socialist Kyrgyzstan. In H. Kreutzmann (Ed.), *Pastoral practices in high Asia. Agency of 'development' effected by modernisation, resettlement and transformation* (pp. 145–160). Dordrecht Heidelberg, New York London: Springer.
- Stirrat, R. L., & Henkel, H. (1997). The development gift: The problem of reciprocity in the NGO world. *The American Academy of Political and Social Science*, 554(1), 66–80.
- Stockbruegger, J., & Bueger, C. (2017). Actor-network theory: Objects and actants, networks and narratives D. R., McCarthy. In *Technology and world politics*. London: Routledge.
- Swidler, A. N. N., & Watkins, S. C. (2009). 'Teach a Man to Fish': The sustainability doctrine and its social consequences. *World Development*, 37(7), 1182–1196.
- Tatnall, A. (2011). *Actor-network theory and technology innovation: Advancements and new concepts*. Hershey, New York: Information Science Reference.
- Wang, Y., Yue, H., Peng, Q., He, C., Hong, S., & Bryan, B. A. (2020). Recent responses of grassland net primary productivity to climatic and anthropogenic factors in Kyrgyzstan. *Land Degradation and Development*, 31(16), 2490–2506.
- Wardle, C., & Zakiriaeva, N. (2018). Sustainability and long-term impact of community-managed water supply in rural Kyrgyzstan, Central Asia. *Waterlines*, 37(2), 118–131.
- WCED (1987). *Report of the World Commission on Environment and Development: Our Common Future* Accessed 21 October 2021. From <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>.
- Wiltsey Stirman, S., Kimberly, J., Cook, N., Calloway, A., Castro, F., & Charns, M. (2012). The sustainability of new programs and innovations: A review of the empirical literature and recommendations for future research. *Implementation Science*, 7(17). doi:10.1186/1748-5908-7-17
- Wiltsey, S. S., Kimberly, J., Cook, N., Calloway, A., Castro, F., & Charns, M. (2012). The sustainability of new programs and innovations: A review of the empirical literature and recommendations for future research. *Implementation Science*, 7(1), 17. doi:10.1186/1748-5908-7-17.
- Yu, L., & Kasymov, U. (2020). Social construction of Pastureland: Changing rules and resource-use rights in china and Kyrgyzstan. *International Journal of the Commons*, 14(1), 1–15.