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OPEN INNOVATION AND KNOWLEDGE APPROPRIATION IN AFRICAN MICRO AND SMALL ENTERPRISES (MSEs)

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ABSTRACT
This article seeks enhanced understanding of the dynamics of open innovation and knowledge appropriation in African settings. More specifically, the authors focus on innovation and appropriation dynamics in African micro and small enterprises (MSEs), which are key engines of productivity on the continent. The authors begin by providing an expansion of an emergent conceptual framework for understanding intersections between innovation, openness and knowledge appropriation in African small-enterprise settings. Then, based on this framework, they review evidence generated by five recent case studies looking at knowledge development, sharing and appropriation among groups of small-scale African innovators. The innovators considered in the five studies were found to favour inclusive, collaborative approaches to development of their innovations; to rely on socially-grounded information networks when deploying and sharing their innovations; and to appropriate their innovative knowledge via informal (and, to a lesser extent, semi-formal) appropriation tools.

KEYWORDS
open innovation, collaborative dynamics, knowledge appropriation, access to knowledge (A2K), intellectual property (IP), micro and small enterprises (MSEs), informal sector, Africa

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INTRODUCTION
The complex relationship between appropriation and innovation is being questioned across numerous disciplines. Scholars in law, economics, management, political science, development studies and other fields of study are investigating whether the appropriation of knowledge, especially via formal intellectual property (IP) rights, leads to more or less innovation. Some suggest the ability to appropriate knowledge facilitates innovation, while others suggest that appropriation frustrates innovation, especially in the context of sequential or cumulative innovation. Such differences of opinion are not merely academic. These issues are at the core of national and international policy debates involving governments, industry and civil society.

Global trade negotiations in the early 1990s culminated in the legal codification – through the World Trade Organisation's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) – of logic, critics explain, presupposing that more IP protection will drive more innovation (Drahos & Braithwaite, 2002). In response to the ratcheting up of IP protection, however, a counter-movement of scholars and activists coalesced around the theme of access to knowledge, "A2K" for short, (De Beer & Bannerman, 2013; Kapczynski, 2008; Krikorian & Kapczynski, 2010).

A common concern motivating the A2K movement was not that IP rights are inherently problematic, but rather that often access to knowledge is as important, or more important, than appropriation of knowledge, to the processes that drive innovation. While many individual firms might profit from greater proprietary control over knowledge, if one takes a macro-economic perspective one can convincingly argue that more wealth will be generated, and distributed more equitably, through "open" approaches to knowledge governance. The free and open source software (FOSS) movement, which emerged in the 1980s, provided a key practical illustration of the virtues of an open approach to knowledge management. Creators and innovators across a wide range of sectors – from green technology development to film production to mobile phone application design, and much else in between – are now adopting open approaches to their knowledge. And just as the practical landscape of approaches to knowledge appropriation continues to evolve, so too does the conceptual terrain. Expressions such as "peer production", the "knowledge commons", "open development" and "open innovation" all have wide currency.

In the African context, it is particularly important, in both policy and practical terms, to understand how openness and appropriation affect innovation in micro- and small-enterprise (MSE) settings. Typically operating informally, African MSEs generate a significant proportion of the economic productivity on the continent. Accordingly, it is our view that a better understanding of the dynamics of innovation, openness, and knowledge management as practised by these small enterprises is critical to equipping policymakers with the evidence they need in order to craft policy tools that foster

sustainable socio-economic development on the continent. In this article, we take some of the current conceptual understandings of innovation, openness and knowledge appropriation and bring them to bear on findings from two recent research projects with an African MSE focus.

We set out our analysis knowing that the two research projects from which we secondarily source data and findings are pioneering endeavours in a largely unexplored empirical domain. (We are not aware of any other research initiatives on the continent that have focused on innovation and knowledge appropriation in MSE contexts.) Thus we do not overstate the conclusiveness of our analysis. There is still much work to be done, both empirically and conceptually, in this research area. Also, we do not imply with our analysis that the African continent is homogeneous in respect of the innovation practices of MSEs. The research findings discussed in this article cannot necessarily be generalised beyond the settings described. That is the nature of the case study methodology, which is especially well-suited to addressing "how" and "why" questions exploring new conceptual territory around contemporary events and behaviours beyond a researcher's control (Yin, 2009, pp. 8-14). These findings, therefore, offer new insights to develop and explain emerging concepts that are at least potentially relevant to other, similar settings on the continent, wherever they may be found.

The next section of this article expands upon an emerging conceptual framework for approaching innovation, openness and knowledge appropriation in African MSEs. We then provide a secondary account of findings from the two research endeavours we are aware of that have produced data relevant to this conceptual framework: the recent case studies of the Open African Innovation Research (Open AIR) network, and the recent work of the World Intellectual Property Organisation (WIPO) Development Agenda project on IP and the Informal Economy (Open AIR, n.d.; WIPO, 2011). [1] We then analyse the findings through the lenses of our conceptual framework, before offering conclusions and a proposed future research direction.

CONCEPTUAL FRAMEWORK

OPEN INNOVATION

Some of the origins of the conceptual linkage between openness and innovation are quite far removed from the African MSE settings that are the focus of this article. US business management scholar Chesbrough coined the term "open innovation" a dozen years ago, with respect to the changing research and development (R&D) practices of large and successful IT firms (Chesbrough, 2003a, 2003b). Chesbrough sought to explain how, for instance, the IT company Cisco could keep pace, in terms of innovation, with its rival Lucent without investing nearly as much as Lucent in internal R&D. Among his findings was that Cisco tended to acquire the technology it needed "from the outside, usually by partnering or investing in promising start-ups (some, ironically, founded by ex-Lucent veterans)" (2003b, p. 2). He characterised this approach to innovation as "open", as compared to a "closed" approach reliant on internal R&D. In the "open innovation model", Chesbrough writes, "the boundary between the company and its surrounding environment is porous […], enabling innovations to move more easily between the two" (2003b, p. 4). The open innovation company, according to Chesbrough "commercializes both its own ideas as well as innovations from other firms and seeks ways to bring its in-house ideas to market by deploying pathways outside its current businesses" (2003b, p. 4).

Today, more than a decade after Chesbrough's formulation, the fusion of notions of openness with notions of innovation is commonplace, and these fusions are made in relation to innovation in multiple contexts, including contexts far removed from the developed-world, large-firm activities that were his focus. To take but one example, in its recently published Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024), the African Union states in section 3.3 on "Innovation and Entrepreneurship" that "[a] multi-disciplinary and multi-sectoral approach to Collaborative Open Innovation and Entrepreneurship is essential to achieving the Knowledge Economy and sustainable socio-economic development across Africa" (AU, 2014).

The AU's reference to "collaborative open innovation" is not necessarily an endorsement of Chesbrough's insights. A recent article by West, Salter, Vanhaverbeke and Chesbrough (2014, p. 808) makes clear that Chesbrough's conception is "an (unabashedly) firm-centric theory of innovation". The AU's focus, however, is more on macro-economic policy frameworks than management strategy. This focus is aligned with other innovation scholars more interested in individual, consumer and societal welfare. Von Hippel and Baldwin use the term "open collaborative innovation" to describe non-proprietary innovation that is freely accessible to anyone (Von Hippel, 2005; Baldwin & Von Hippel, 2011). The legal academic Benkler (2006) uses the term "commons-based peer production" to explain how innovation happens without the proprietary incentives that drove the hierarchical industrial models of the past.

Conventional approaches to knowledge appropriation have emphasised formal IP rights as necessary to control knowledge in order for innovation to occur. The approach of the closed-innovation firm was "[w]e should control our intellectual property (IP) so that our competitors don't profit from our ideas", while the open-innovation firm decided "[w]e should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model" (Chesbrough 2003b, p. 5). Arguing for a broader approach to strategic knowledge sharing, Hall (2010) has recently pointed out that "[t]here are limits to IP as a tool for organizing open innovation", and there are many examples of open innovation "involving the free exchange of ideas and improvements" (2010, p. 4). Hall cites, as examples, the free exchange of knowledge that was central to development of the Bessemer steel process, to development of the steam-powered pumping engine for

1 Author De Beer is a co-founder and director of the Open AIR network, and he co-authored the conceptual paper for the WIPO Development Agenda project on IP and the Informal Economy (De Beer et al., 2013). Author Armstrong is a collaborator in the Open AIR network's South Africa team.

mining in Cornwall, and to development of silk-weaving in Lyons. Hall also points out that "[e]ven today the Web 2.0 sector is characterized by a relative lack of attention to IP issues and a great deal of effort devoted to interoperability" (Hall, 2010, p. 4). As will be seen below in the section on recent research findings, this "lack of attention to IP issues" as cited by Hall as a feature of the high-tech Web 2.0 world is also present in innovative informal or semi-formal African MSE settings.

In the firm-centric paradigm, "open innovation" means the *firm* is open to innovation in collaboration with outsiders. In the systems-wide paradigm, "open and collaborative innovation" means the *innovation* is open for use without proprietary restrictions. For the AU and other policymaking bodies seeking to support innovation on the continent, the different connotations of what are very similar terms present a potentially hidden conceptual danger. In the firm-centric model, strong appropriation (via IP rights, for example) helps to facilitate open innovation. But in a system-wide model, maximalist appropriation may hinder innovation, in part by inhibiting access to knowledge with increased transaction costs or inappropriate indicators of desirable outcomes. The confusion and contradictions among researchers about the relationship between appropriation and "open" innovation presents a serious impediment to development of effective marketplace framework and innovation policies (De Beer, 2015).

The common theme across firm-centric and systems-wide models of "open" innovation is that innovation happens when knowledge is exchanged throughout knowledge networks (De Beer, 2015). An emphasis on networks, and on prioritisation of exchange over exclusion, provides a conceptual bridge between notions of open innovation and the growing body of literature on the concept of networked "open development".

The volume *Open Development: Networked Innovations in International Development* (Smith & Reilly, 2013) provides chapters from all corners of the globe looking at how various gradations of openness in networked knowledge-management settings contribute to realising socio-economic development outcomes. Many of the conceptions in this path-breaking volume are useful for interrogating African MSE innovation. Here, we take work on open development in two new directions.

First, the nuances of open innovation and appropriation are for the most part not explicitly confronted in the existing open development literature. While there is mention of efforts by Australia's Cambia institute, via an initiative called the Initiative for Open Innovation, to support pooling of patent information for developing-country innovators (Masum et al., 2013, p. 121), in this present article we seek to squarely consider how IP tools facilitate or frustrate such initiatives.

Second, the settings examined in this article do not entirely align with most of the networked open models covered in the open development literature, much of which focuses on information and communication technologies (ICTs) such as the Internet and mobile telephony. In contrast, the innovation cases discussed in this article are not primarily ICT-enabled. In this way, we take seriously the statement in the Open Development volume's conceptual framing chapter (Reilly & Smith, 2013) that "while open models rest on technology, they are more properly social systems with information-networked structures and activities" (Reilly & Smith, 2013, p. 30, italics in original). We agree that it is the foundational "social" elements, rather than technological elements, that are the true drivers of information networking for innovative purposes. And, as is posited in the next prong of our conceptual framework, the social dynamics of innovation are thought to be particularly crucial in African MSE settings.

INNOVATION IN AFRICAN SMALL-ENTERPRISE SETTINGS

A 2011 World Bank report (Yoshino, 2011) on industrial clustering of MSEs in sub-Saharan Africa outlines the "dualistic structure" of Africa's private sector, as follows:

> […] a large number of micro and small enterprises, mostly indigenous domestic enterprises operating in an informal setting, coexist with a small number of large enterprises, often foreign-owned or former state-owned enterprises. (Yoshino, 2011, p. 11)

The World Bank's characterisation of the private sector on the African continent, as driven to a substantial extent by small-scale informal enterprises, is supported by figures from the International Labour Organisation (ILO). The ILO in 2013 estimated that informal enterprises were contributing 50% of gross value added (GVA) in sub-Saharan Africa (ILO, 2013a, p. 3).

According to 2014 estimates for selected countries, informal employment accounted for 33% of non-agricultural employment in South Africa, 44% in Namibia, 76% in Tanzania, 82% in Mali, and 66% on average across the sub-Saharan African countries studied (Vanek et al., 2014).

There is some debate as to how the informal sector, and informal enterprises, should be defined. The main point of contention is whether emphasis should be placed on an enterprise's registration (within a relevant legal or administrative framework) or on the nature of its production (how the enterprise is organised and performs its activities). The ILO has adopted a definition that blends both elements – registration status and mode of production – and indicates that "enterprises of informal employers" are defined as enterprises that correspond to "one or more" of three criteria: (1) "small size of the enterprise in terms of employment"; (2) "non-registration of the enterprise"; and (3) "non-registration of its employees" (ILO, 2013a, p. 19). Thus, according to the ILO definition, an enterprise that is

registered can still be regarded as informal, due to its small size and/or lack of registration of employees.

The ILO, World Bank and other large role-players seeking to promote sustainable enterprise development in developing countries are typically fulsome in their praise of the dynamism of informal enterprises. For example, the ILO states that the "[t]he informal sector is important not just as a source of employment but also for the production of goods and services" (ILO, 2013a, p. 3). And the World Bank, in the foreword to its *World Development Report 2013*: Jobs, states that "the jobs with the greatest development payoffs [...] are not only found in the formal sector; depending on the country context, informal jobs can also be transformational" (World Bank, 2012, p. xiii).

But at the same time, many influential organisations see the developing world's huge informal sectors as, to some extent, a problem to be solved. In its 2013 report *Transitioning from the Informal to the Formal Economy,* the ILO states that there exists a "global consensus that inclusive development is not possible unless rights and opportunities are extended to workers in the informal economy", and that "[t]he persistence of a large informal economy is incompatible with substantial progress in achieving decent work and undermines the ability of enterprises to become more productive" (ILO, 2013b, p. 5). Similarly, the World Bank views informality as a stage that African enterprises need to evolve out of, in order to realise their "untapped potential" (Lin, 2011, p. xiii). In the words of the foreword to a 2011 World Bank report on African MSEs:

> In every major commercial city, concentrations of micro and small enterprises are engaged in a range of manufacturing activities – from metalwork to carpentry and furniture making, from garments to food making. Those enterprises constitute the lion's share of manufacturers in the region. They are also potential sources of employment, skill development, and therefore poverty reduction. (Lin, 2011, p. xiii)

The goal, according to this World Bank report (Yoshino, 2011), is for African MSEs to make a "successful transformation" from "survivalist" informal MSEs to formal enterprises (2011, p. 108). Thus, for entities such as the World Bank and the ILO, Africa's huge MSE informal sector is both a valuable source of economic productivity and, at the same time, a problematic sector that must be transitioned into formality.

Our stance in this article is different. We share the concern that participants in Africa's informal sector are highly vulnerable to exploitation, impoverishment, and numerous other negative outcomes. However, we are of the view that an emphasis on formalisation as the sole viable way forward for these enterprises is not realistic, nor necessarily desirable. There is a clearly plausible scenario for Africa's future in which informality is not supressed but celebrated (Elahi & De Beer, 2013). We agree with Sparks and Barnett (2010) that "the debate about formal/informal dualism needs to end. Governments need to unequivocally recognize and admit the importance of the informal sector and find ways to encourage its growth" (2010, p. 5). We are also cognisant of the fact that, in the absence of strong labour laws and protections, *formalised* enterprises can in fact be tools of extreme exploitation.

In April 2015, *The Economist* published an article entitled "Africa's innovation revolution" in which it spoke of "[a] continent that has long accepted technological hand-me-downs from the West" now "increasingly innovating for itself" (The Economist, 2015). The article went on to say that

> [i]nnovation in Africa is helped by a peculiar confluence of economic and political circumstances. Regulation is generally light thanks to weak governance; engineers can try things out that are either prohibited or prohibitively bureaucratic elsewhere. It is also buoyed by the paucity of traditional infrastructure, whether roads or landlines, meaning that new technologies or business models face few established competitors. (*The Economis*t, 2015)

The Economist's focus in its article was on large firms, not small enterprises. But there is evidence to suggest that the African "innovation revolution" is also occurring at the level of informal MSEs. To analyse innovative activity in Africa's informal small-enterprise settings, we follow the guidance of Szirmai, Naude and Goedhuys (2011) to move beyond a "narrow strictly technological" approach to innovation that focuses on "product and process innovations" (2011, p. 5). We adopt the broader approach that takes into account not only new products and processes but also "new sources of supply", "exploitation of new markets", and "development of new ways to organize business" (Szirmai et al., 2011, p. 5).

As Szirmai et al. (2011) and numerous others point out, developing-world innovation is often "incremental" rather than "radical." Szirmai et al. (2011) emphasise the well-accepted idea that "innovation does not only refer to the first introduction of novelty by a first mover, but also to the spread of the innovation to other actors in the economy" (2011, pp. 5-6). Another important distinction is among innovations "new to the world", innovations "new to the domestic market", and innovations "new to the firm". New-to-the-world innovations are "primarily found in the advanced economies" and are "based on research and development at the frontiers of global knowledge", while in the developing world, "innovations will tend to be new to the market or new to the firm" – and "some kinds of innovation that are new to small firms in developing countries may coexist with stagnant economies and increasing technology gaps relative to the international frontier" (Szirmai et al., 2011, p. 6).

Another prominent feature of developing-world innovation is its communal, collaborative element, as highlighted in the De Beer et al. (2014) volume on the "collaborative dynamics" of innovation and IP in Africa, and as characterised by Kraemer-Mbula and Wamae (2010, p. 12) as innovation often driven "by knowledge gained through learning by

doing, collaboration and information networks". The aforementioned 2011 World Bank study of dynamics among clusters of African MSEs points to "the significant role of informal social networks that increase the flow of information among indigenous firms, reduce search costs, build trust relationships, and reduce transaction costs" (Yoshino, 2011, p. 27). This emphasis on the dynamism of knowledge networking in developing-world settings also connects to the aforementioned open development conceptual framework provided by Reilly and Smith (2013).

Also helpful in understanding the dynamics of African small-enterprise innovation activity is the work of Drahos and Frankel, whose 2012 volume Indigenous People's Innovation, while focused on examples from Australia and New Zealand, provides insights that are instructive to understanding innovation in African small-enterprise settings (many of which are impacted by indigenous knowledge). Drahos and Frankel (2012) put forward an "information theoretic perspective" on innovation, which "locates innovation in collective processes of generating information to reduce uncertainty", whereby "[a] society may choose to invest its resources into information that expresses itself more in services and processes than in technological artefacts" (2012, p. 21). Drahos and Frankel argue that

> [t]he innovation output of indigenous societies is best understood at the level of systems maintenance, where the systems being maintained are interlocking ecological systems and sub-systems. [...] To maintain the health of a river is also to contribute to the maintenance of flora and fauna that depend on the river. In a cycle of innovation dependence, one technique or set of techniques acts as part of a set of complex conditions that help to promote other forms of innovation. (Drahos & Frankel, 2012, p. 22)

Drahos and Frankel further say that in indigenous societies, "[r]esources are devoted to innovation in systems maintenance, rather than to the generation of technological artefacts" (2012, p. 23).

KNOWLEDGE APPROPRIATION BY AFRICAN MSEs

The final conceptual tool we need to outline, before turning to recent research findings, is a framework for understanding approaches to knowledge appropriation by innovative African MSEs. For this framing we rely on the conceptual work done under the auspices of the aforementioned WIPO Development Agenda project on IP and the Informal Economy (WIPO, 2011). (This is also the project that generated three of the case studies discussed below in the "Recent research findings" section.) The WIPO Committee on Development and Intellectual Property (CDIP) established the IP and the Informal Economy project in 2011 in order to implement the call, in WIPO Development Agenda Recommendation 34, for "a study on constraints to intellectual property protection in the informal economy, including the tangible costs and benefits of intellectual property protection [...]" (WIPO, 2007).

The conceptual working paper for the project (De Beer et al., 2013) builds upon the scarce literature in this field, distinguishing among three ways to appropriate knowledge, as follows:

- *Formal*: "[l]egally anchored, formal mechanisms of intellectual property appropriation", e.g., IPRs such as patents, trademarks, industrial designs and copyrights.
- *Semi-formal:* "[i]ndirect means of appropriation with a lesser degree of legal formality", e.g., secrecy, publishing, non-competition clauses, non-disclosure agreements and contracts.
- *Informal:* "[i]ndirect and informal", e.g., lead-time, complexity (of design/technology), after-sales and other services, customer loyalty but also family/community mechanisms, in tandem with community sanctions/ostracism for copying/imitation (De Beer et al., 2013, pp. 31-32).

The WIPO IP and the Informal Economy project concept paper also sets out two key questions that need to be asked in relation to the forms of appropriation present in an innovation context, as follows: (1) "To what extent do these appropriation schemes foster innovation and the diffusion of knowledge?" and (2) "To what extent does the absence of appropriation harm the scalability, diffusion and impact of innovation?" (De Beer et al., 2013, p. 32).

We will now provide an outline of research findings, relevant to our expanded conceptual framework, generated by the aforementioned Open AIR network and WIPO Development Agenda project on IP and the Informal Economy.

RECENT RESEARCH FINDINGS

The only recent case study research initiatives we are aware of with a specific focus on innovation and knowledge appropriation in African small-enterprise settings are the work of the Open AIR network and of the WIPO Development Agenda project on IP and the Informal Economy. From these two projects, there are five case studies, summarised below in the Table, which offer insights relevant to the conceptual framework we have just outlined: two of the studies by Open AIR, and all three of the studies from the WIPO Development Agenda project.

TABLE1: CASE STUDIES OF INNOVATION AND KNOWLEDGE APPROPRATION IN AFRICAN MSE SETTINGS

Study focus	Location(s)	Research method(s)	Project (publication year)
Informal-sector auto parts fabricators	Kampala, Uganda	Informal consultations and interviews	Open AIR (2014)
Traditional medicine practitioners	Bushbuckridge, South Africa	Participant observation and interviews	Open AIR (2014)
Traditional medicine practitioners	Ghana	Interviews and focus groups	WIPO Development Agenda (2013)
Informal-sector metalworkers	Nairobi, Kenya	A qualitative survey and interviews	WIPO Development Agenda (2013)
Informal-sector manufacturers of cosmetics and household cleaning products	Gauteng and Eastern Cape Provinces, South Africa	Interviews	WIPO Development Agenda (2013)

THE OPEN AIR STUDIES

The Open AIR network, which at the time of this article's publication has a multi-disciplinary team of researchers across 14 African countries, conducted a series of case studies in 2011-13 that looked at IP dynamics in a variety of innovation contexts.[2] Two of the Open AIR studies, in particular, generated findings relevant to our focus in this article on innovation, openness and knowledge appropriation in African small-enterprise settings:

- a study of innovation exchanges between informal-sector and formal-sector auto parts makers, and within a network of informal-sector artisans, in the Ugandan capital Kampala; and
- a study of knowledge-sharing among traditional healers in the Bushbuckridge region of South Africa.

UGANDAN AUTO PARTS FABRICATORS

This Kampala-based case study (Kawooya, 2014) found that informal-sector automotive artisans with no formal training were working with Makerere University engineering staff and students on development of an electric car prototype. While Makerere academics and students designed the car, called the Kiira EV, informal-sector artisans were called upon to fabricate some of its parts. The study found a two-way innovation transfer between the informal- and formal-sector actors, via a workshop, Gatsby Garage, managed in part by the university. The electric car prototype was successful, with the project receiving wide publicity, including a ride in the prototype by Ugandan President Yoweri Museveni (The Guardian, 2011).

This research revealed that while informal artisans were required to sign non-disclosure agreements (NDAs) compelling them not to share the Kiira EV designs with outsiders, there was a high degree of idea- and design-sharing within the formal-informal collective that fabricated parts for the car (Kawooya, 2014). According to study researcher Kawooya: "the role of IP protection issues was found to be minimal in the actions and thinking of the informal artisans. IP only became an issue on occasions when formal-sector entities raised IP matters in the course of sharing their innovations with informal-sector entities […]" (Kawooya, 2014, pp. 65-66). It was found that while the formal-sector parties sought to semi-formally appropriate their knowledge via the NDAs, the informal-sector parties were largely unconcerned with semi-formal appropriation (let alone formal appropriation), because the appropriation methods they were accustomed to were informal.

Among the informal-sector artisans, there was a high degree of sharing of innovative knowledge, often via apprenticeships provided by older artisans to younger artisans – with the apprenticeships typically established on the basis of family and friendship connections. The informal-sector workers also engaged in a great degree of informal networking in order to, inter alia, source materials and gain access to necessary machinery. According to Kawooya, "[w]ith the exception of one artisan, the participants found the notion of owning ideas, innovations or inventions antithetical to the workings of the informal sector, where collaboration and sharing is the norm rather than the exception" (Kawooya, 2014, p. 72). Kawooya also found that "[n]one of the informal-sector participants was aware of IP laws that could protect their innovations" and that "they remained unconcerned about IP even after I provided a brief explanation" (Kawooya, 2014, p. 72).

SOUTH AFRICAN TRADITIONAL HEALERS

This study (Cocchiaro et al., 2014) examined the knowledge management practices of a network of traditional healers, the Kukula Traditional Health Practitioners' Association, in South Africa's Bushbuckridge region. In 2009, roughly 80 healers came together to create a traditional knowledge commons, or "TK commons", that documents and pools their innovations. The commons is governed by a bio-cultural community protocol (BCP), which provides rules for members' use of the knowledge as well as guidelines for access and benefit-sharing agreements with outsiders wanting access to the knowledge. Before pooling their innovations, the healers' knowledge tended to be passed down within particular families or ethnic groups. Via the commons, the knowledge was now being shared more horizontally, across family and ethnic lines, "largely based on the trust relationship between healers regardless of their ethnic affiliations or levels of experience (Cocchiaro et al., 2014, p. 160). However, certain knowledge that according to custom must always be kept

2 Findings from the Open AIR studies have been published by UCT Press in a volume, edited by De Beer, Armstrong, Oguamanam and Schonwetter, entitled *Innovation and Intellectual Property: Collaborative Dynamics in Africa* (De Beer et al., 2014).

secret by its practitioners was not shared, and "members of the group do not share all knowledge because of concerns that it could lead to the weakening of their individual healing specialisations" (Cocchiaro et al., 2014, p. 160).

The research found that through the commons, the healers were not only more easily able to share their innovations, but also to practice better conservation (e.g., preventing over-harvesting of medicinal plants), to negotiate with government authorities for controlled access to nature reserve areas containing plant materials, and even to negotiate an access and benefit-sharing arrangement with a private-sector cosmetics and bedding company, Godding and Godding, which sought access to some of the Kukula healers' innovations for possible development of commercial products (Cocchiaro et al., 2014).

THE WIPO DEVELOPMENT AGENDA PROJECT STUDIES

This WIPO Development Agenda project on IP and the Informal Economy produced three case studies of knowledge management in African informal, MSE innovation settings. The studies looked at the work of:

- Ghanaian traditional medicine practitioners (TMPs);
- informal-sector metalworkers in the Kenyan capital Nairobi; and
- South African informal-sector manufacturers of home and personal care products.

GHANAIAN TRADITIONAL MEDICINE PRACTITIONERS (TMPs)

This Ghanaian study (Essegbey et al., 2013) surveyed more than 100 TMPs and found that the majority of respondents operated in a largely informal fashion. The TMPs were found to be engaging in innovative behaviour in relation to the composition of their products, the products' packaging, production processes, product marketing, and delivery of services to clients (Essegbey et al., 2013). The most commonly used form of knowledge appropriation among the TMPs was secrecy, which TMPs said they used in order to prevent others from commercialising their innovations. But at the same time, more than 90% of the practitioners said they supported the notion of "open transfer or exchange of innovation/innovative ideas", which led the study authors to conclude that "respondents might not have thought through carefully the implication of open access" (Essegbey et al., 2013, p. 41).

KENYAN METALWORKERS

The study of informal metalworking in Nairobi (Bull et al., 2013) surveyed metalworkers in three contexts: a cluster of artisans making commodity products such as pots and pans, targeted at low-income consumers; a cluster of artisans making higher-value items for middle- and upper-income consumers; and artisans working in isolation (not in a cluster). Innovations were found in all three contexts, but differences were found in the approaches to knowledge management (Bull et al., 2013).

Participants in the cluster making low-value items did not seek to engage in appropriation of innovations, relying mostly on trust relationships and sharing of resources within the collective in their efforts to respond to customer demand. In this cluster, there was also some "willingness to take advantage of being first to market and of exclusive relationships with customers" (Bull et al., 2013, p. 2). Participants in the cluster making higher-value items "put more energy into maintaining any advantage" via, for example, using secrecy to protect knowledge of certain production processes (Bull et al., 2013, p. 2). The artisans operating in isolation were found to be somewhat interested in formalised protection of IP, such as trademarks and utility patents, but they made little use of formalised IP because they found the appropriation process too difficult (Bull et al., 2013).

SOUTH AFRICAN HOME AND PERSONAL CARE PRODUCT MANUFACTURERS

This study (Kraemer-Mbula & Tau, 2013) examined the work of informal manufacturers of home and personal care products in South Africa's Gauteng and Eastern Cape Provinces. The study found significant evidence of incremental product innovations, and a lesser degree of evidence of incremental process innovations. In terms of knowledge appropriation, it was found that "[s]elective sharing of information, secrecy, division of duties and management of customer relationships" were the most-used forms. Use of formal mechanisms such as patents and trademarks was scarce (Kraemer-Mbula & Tau, 2013, pp. 2-3).

In respect of the aforementioned mechanism of "selective sharing of information", which 72% of the respondents regarded as an important tool of knowledge management, the authors found that this mode of exchange "does not involve monetary transactions, but appears to be guided by a code of honor and trust amongst producers, and a sense of responsibility to their community" (Kraemer-Mbula & Tau, 2013, p. 49). The authors also found that the informal manufacturers voiced an appreciation for open transfer of ideas, but at the same time the respondents were "often unaware of mechanisms of knowledge appropriation that would suit their needs" (Kraemer-Mbula & Tau, 2013, p. 3).

ANALYSIS

Drawing on the findings just outlined from the five studies of innovative African MSEs, we now present an analysis grouped according to the three themes of the conceptual framework provided above:

- open innovation;
- innovation in African small-enterprise settings; and
- knowledge appropriation by African MSEs.

OPENNESS FOR INNOVATION

Above we presented a hybrid firm-centric and systems-wide view of open innovation as innovation that is driven by networks and focused on knowledge exchange rather than exclusion, and we also proposed that in the case of African MSE settings, the networking function should be seen primarily in terms of socially-enabled, not technologically-determined, dynamics. Four of the five studies outlined above provide findings that appear to support these conceptions of openness-oriented innovation.

The Ugandan informal-sector workers were found to be extremely active exchangers of knowledge, both among themselves and in their interactions with formal-sector players. The Kukula healers of South Africa were also engaged in exchange of information within their collective of more than 300 members. There was also evidence of active knowledge exchange among the clustered informal-sector metalworkers in Kenya and the informal-sector personal and home care product manufacturers in South Africa. There was also strong evidence in these five innovation settings of the knowledge exchange that was socially grounded, i.e., driven by communal/family networks and other networks of trust. Only in the case of the Ghanaian TMPs was the knowledge exchange dynamic not clearly present – though even in this case, more than 90% of the practitioners answered in the affirmative when asked whether they agreed with idea of "open transfer or exchange" of innovations.

But it must also be pointed out that in each instance where the dynamic of knowledge exchange was present, there were limits, i.e., there were elements of "exclusion" at play. For the Ugandan auto parts makers, South African healers, Kenyan clustered metalworkers and South African home and personal care product makers, because knowledge exchange was primarily engaged in on the basis of trust networks, there were implicitly outsiders not being engaged with for the purposes of information exchange. This does not dilute the finding that these innovators had a strong orientation toward openness; it merely reveals that their ethic of openness was not absolute.

INNOVATION IN AFRICAN MSEs

The propositions cited above, from the work of Kraemer-Mbula and Wamae (2010), that innovation in developing-world settings tends to be characterised by "learning by doing", "collaboration", and "information networks", also appear to be borne out by findings from the studies. The Ugandan informal-sector auto parts makers were found to rely to a great extent on learning by doing (and informal apprenticeships allowing apprentices identified via family and kinship links to learn by doing) in order to develop and pass on their innovations. And the Kukula healers of South Africa were found to be displaying a high degree of information networking, through regular face-to-face meetings and gradual expansion of the size of their healers' network (starting with 80 healers and growing to a network of more than 300 members by the time of the Open AIR research in 2011-12).

As well, many of the innovative behaviours identified across the five case studies fit with conceptions of developing-world innovation cited above from the work of Szirmai et al. (2011) and Drahos and Frankel (2012). The innovations identified were typically incremental (as opposed to breakthrough), and their identification required the researchers to take a broad perspective on innovation of the sort proposed by Szirmai et al. (2011) – a perspective that takes account of innovation in "sources of supply", "exploitation of new markets", and finding "new ways to organize business" (2011, p. 5). For example, in respect of innovation in source of supply, the metalworkers in both the Ugandan and Kenyan studies were found to display significant ingenuity in sourcing the necessary materials (Kawooya, 2014; Bull et al., 2013).

And some of the innovative behaviours of the Kukula healers in South Africa would appear to be examples of what Drahos and Frankel (2012) describe, in the passage quoted above, as "systems maintenance" behaviours, whereby "the systems being maintained are interlocking ecological systems and sub-systems" (2012, p. 22). In their efforts, via their TK commons, to better manage stewardship of the medicinal plants on which their traditional medical provision depends, the Kukula healers are engaged in maintenance of the health of both plant and human participants in the local ecosystem.

KNOWLEDGE APPROPRIATION BY INNOVATIVE AFRICAN MSEs

When the findings of the five studies are viewed in terms of the three modes of appropriation cited above from De Beer et al. (2013) – formal, semi-formal and informal appropriation – it is the second and third categories, semi-formal and informal, that are most apparent.

A key semi-formal appropriation technique identified in all five studies was secrecy. Another semi-formal mechanism – contracting – was present in the work of Kukula healers, who had signed an access and benefit-sharing agreement with a cosmetics and bedding company, Godding and Godding, seeking access for potential commercialisation purposes to some of the Kukula TK. The Ugandan informal auto parts makers also engaged in a form of contracting, by signing non-disclosure agreements (contracts promising secrecy) with Makerere University in order to be able to participate in production of the Makerere electric car prototype. It is important to note that in each of these two contracting cases, the contracts arose due to the small-enterprise innovators needing to interact with larger, and formalised, entities. (In the case of the Ugandan auto parts makers, it would seem that the informal workers were exploited to some extent in their relationship with the Makerere researchers – via a power asymmetry generated by different attitudes towards knowledge appropriation mechanisms.).

Examples of informal appropriation techniques were numerous in the studies, including instances of all of the examples provided by the conceptual paper of the WIPO Development Agenda project on IP and the Informal Economy: lead-time, complexity, related services, customer loyalty, family/community mechanisms, and peer/community sanction (De Beer et al., 2013).

In response to the first of the two core appropriation questions posed in WIPO Development Agenda project conceptual paper – "To what extent do these appropriation schemes foster innovation and the diffusion of knowledge?" (De Beer et al., 2013, p. 32) – it seems clear that the informal, and to a lesser extent semi-formal, appropriation mechanisms identified were succeeding in fostering innovation and knowledge diffusion in the African small-enterprise settings studied.

In answer to the second appropriation question from – "To what extent does the absence of appropriation harm the scalability, diffusion and impact of innovation?" (De Beer et al., 2013, p. 32) – there was evidence that the Kukula healers in South Africa had achieved significant scale in the absence of formal appropriation, growing from an initial 80 members in 2009 to 300 healers in 2012, and with a membership drawn from across a wide geographical area in northeast South Africa, including parts of two provinces (Limpopo and Mpumalanga). And two of the other sets of actors studied – the Kenyan metalworkers and the South African personal and home care product makers – also exhibited elements of scale in the absence of formal appropriation, via collaborating within geographically defined clusters. (We saw earlier that the World Bank (Yoshino, 2011) has identified clustering as a key dimension of MSE activity in sub-Saharan Africa.).

CONCLUSIONS AND FUTURE RESEARCH

Case study data and research findings are not necessarily generalisable. This is particularly true in the highly diverse and dynamic context of Africa's informal MSEs. But case studies such as those reviewed in this article are among the best methods to explore the boundaries and nuances of emerging conceptual frameworks.

Relying on secondary data, which was collected through two recent research projects, we have shed new light on the intersections amongst openness, innovation, appropriation and development. Such insights have the potential to help researchers and policymakers further refine their understanding of these topics. The findings presented in this article support the conclusions that:

- African MSEs can and do orient themselves towards openness and inclusion, rather than exclusion, in their innovation practices;
- MSEs' knowledge networking for innovation can and does rely to great extent on offline, socially constructed linkages; and
- MSEs can and do favour informal appropriation approaches, and to a lesser extent semi-formal appropriation practices, for their innovative knowledge.

Nevertheless, the MSE innovation context on the African continent remains an under-researched area, with many gaps to be filled. Among these apparent gaps is research into the scalability of MSE innovation models. This is a gap that the Open AIR network will seek to address with its next phase of research, beginning in 2016. A central question will, in our view, need to be: to what degree does scaling-up of MSEs' innovation models require increased formality, in an operational sense and/or in relation to knowledge appropriation?

The complexity of the appropriation question, in particular, is hinted at by the authors of the Kenyan case study discussed above. In their recommendations based on the research, Bull et al. (2013) point out that, in respect of the Kenyan informal-sector metalworking clusters they studied,

> it is critical to recognize that the values prized by those working in clusters – relationships based on trust and the sharing of resources – are vital to the functioning of the larger society. These values are sometimes seen as being at odds with protecting an individual's intellectual property. (Bull et al., 2013, p. 2)

Bull et al. (2013) go on to argue that it "is not necessarily true" that protecting IP goes against the trust and sharing values central to cluster dynamics, and, accordingly, policymakers need to "seek innovative solutions" capable of nurturing both "valuable cultural norms and individual rights" (2013, p. 2).

We agree with Bull et al. (2013) that it is not necessarily a given that formalised appropriation (i.e., IP protection) is irreconcilable with innovation-sharing. Yet it is our sense, in light of the research discussed above, that formal appropriation will in many cases *not* be fully compatible with collaborative innovation in African small-enterprise settings. Which brings us back to the question of what is to happen to appropriation dynamics when such enterprises seek to scale up. Does the scaling-up require more formalised approaches to appropriation? Or is it a case of the enterprises needing to ensure that, as they achieve greater scale, they continue to harness informal (and, in limited instances, semi-formal) appropriation modes in order to preserve the innovation dynamics core to the success of their enterprises? The answers to these pressing questions for future researchers will be extremely valuable to innovators, and policymakers, on the continent.

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