DISCOVERY

Africa informal technology sector borrowing principles, concepts, theories, techniques and methods from other sectors

Wangai Mambo

ABSTRACT

Informal sector artisans require actionable guidance that is provided by theories and techniques whose strengths and weakness are known, yet the informal sector faces resource scarcity which makes it nearly impossible to develop its theories and techniques. Theories and methods are based on concepts and principles. The African informal sector compared with other informal sectors in the world has fewer explicit theories and methods for building its knowledge and methods bases. A low-cost way for informal sector to have theories and methods is to borrow them and their components from similar domains. African informal technology developing sector is one of grassroots innovation movements around the globe. The study used a design science and literature review, analysis and synthesis and extension research method and codified process for borrowing theories from other fields through this study.

Keywords: Grassroots innovation movement, informal sector, innovation, maker movement, technology catch-up, grassroots movement

1. INTRODUCTION

Hargadon, (2003) presented several innovation rules one of which is analogy is better than invention. Reasons analogy is better than invention is it's cheaper and less risky since analogical solution has been used before, its feasibility proven and its better understood. But there cases invention is better than analogy like when analogical solution is not known, doesn't exist or it more expensive to adapt it. Many Analogical solutions from other sectors with similar of resource scarcity makes borrowing and adapting better than inventing in many cases.

India is the country with largest and most well-developed low cost innovating informal sector. Informal sector innovation institutionalization is based on: Building on bottom-up principles based on local reality, horizontal networking principles, creating organization architectures to support internal informal and external formal to informal sector communication and local, regional and national scalable institutionalization levels (Ustyuzhantseva, 2015). Networking within the informal sector is critical for flow of knowledge and lessons learned that catalyzes innovation. Networks of individuals transform their informal and personal

relations and activities into inter-organization network relations and activities increasing sector business success and performance (Premaratne, 2002; Khaing et al., 2022).

Networking enables combination of knowledge, skills of individuals involved. Several African proverbs indicate this for example "knowledge is power" and" unity is strength". The more people in a network the greater the strength as they have more knowledge and capabilities. A network is not collection of individual but synergetic system interrelating people with common goals. Design can learn from do-it yourself movement low-cost prototyping (Camburn et al., 2017) while informal sector can learn low cost catch-up from design, other maker and do-it-yourself (DIY) movement. Prototyping can be used as method of learning by innovating. Some formal design and innovation methods and theories can be down scaled and adapted for informal sector activities.

Several ways are being used to grow informal sector knowledge base like Infusing design into informal sector (Maina et al., 2017), training informal sector in design (Kidenda, 2019), designers working with informal sector artisans (Sethi et al., 2005), university student do project in industry to transfer skills for lecture to student to industry and vice versa. The same process can be applied to informal sector industries. Engineering emerges from ad hoc practice in two steps from craft production using intuition and brute force creating production problems that stimulate development of science and commercialization theory (Shaw and Garlan, 1996).

Failure of informal sector to develop or borrow theories to deal with is problems hinder sectors growth. Borrowing knowledge can enable informal sector move from sector dominated by intuition and brute force to an emerging informal science, engineering and entrepreneurship discipline. Although borrowing theories is double edge sword with strengths, weakness, opportunities and threats, a half full glass is better than an empty glass as supported by information systems discipline heavily borrowing theories from other disciplines (Tams, 2010).

Information system discipline continues to progress at rate similar to other computing disciplines indicating heavy theory borrowing can work for sectors and fields. Informal sector is better off with borrowed theories than without which can enable it to build capabilities and create internal demand for creation of informal sector specific theories.

The study research objectives are:

To find aspects of formal and informal sector that can be applied to improve African informal sector.

To create a process for borrowing principles, concepts, theories, techniques and methods.

2. METHODOLOGY

The study used literature analogy design science (Gero, 2000) and literature review analysis, synthesis and extension methods. Analogical research method enables finding similarity between informal sector and other sector with valuable knowledge that can be borrowed. Concepts and principles identified can be used as basis for building informal sector theories and methods. A search was done for publications dealing with innovation, design and knowledge management applicable to informal sector. Analogy design science method was used to find similarities and to develop a knowledge borrowing process.

Innovation

Because of lack of resources the poor must optimize their imagination to create low-cost flexible frugal innovations (Beniwal, 2016). Imagination is unlimited resource available to everyone while formal knowledge is expensive to acquire and in beginning may require complete attention without distraction from work activities. Creating knowledge through inventing is strength of maker movement (Dufva, 2017). The informal sector has advantages of both creating new knowledge and a novel product that drives the sectors innovation.

Informal sector has in past been viewed with pessimistic, ironical lens resulting in it being ignored in innovation literature that has been growing drastically, however a new optimistic view has emerged that innovative sector is critical to providing goods and services (Kumar and Bhaduri, 2014). Whatever society views optimistically and values is promoted increasing chances of its thriving and what it views negatively stagnates.

Appropriate support can enable informal sector transform into a modern industrial cluster an exemplar is India shoe cluster (Juma and Clark, 2002). Low-income countries should learn from emerging economies (Kaplinsky et al., 2010) and from developed countries. Informal sector innovation research in developed and developing countries including Africa has gained momentum in last two decades (Kumar, 2020) providing low-cost knowledge basis that can accelerate informal sector innovation. Jua kali is most widely used name for African informal technology sector.

Pro-Poor technology innovation is core to growth of low-income-level innovation systems in developing countries (Foster and Heeks, 2013). Doing using and interacting innovation (Jensen et al., 2007) is best for integrating IK into innovation system by allowing local inhabitants who have marginal or no formal education and lack advanced capabilities to participate (Jauhiainen and Hooli, 2017) to drive growth of informal sectors that is critical for national of growth. Innovation theory is based on global knowledge and indigenous innovation theory should be aligned with global innovation theory.

Inclusive innovation weakness is incorporating all people and sectors into unequal systems and should shift to discussing how certain systems are creating marginalizing boundaries (Jiménez, 2018). When informal sector is incorporated in inclusive policies or national debates it is treated as unreliable sector. Realizing full potential of inclusive innovation requires different measures in India and Russia that take into account cultural, social and psychological specifics of marginalized group inclusion and exclusion (Ustyuzhantseva, 2017).

Failure to leverage some resources in a system result in below optimal performance and is a waste of resources, intellectual capital being most valuable resources. Countries inclusive innovation policies and strategies should consider these factors. To catch-up a country must have substantial proportion of population with technical skills to drive innovation and build capabilities (Wamae, 2006). Africa can only reach critical mass of population with technical innovation skills by integrating and upgrading indigenous knowledge and technical skills through developing informal sector.

Doing using and interacting is dominant innovation approach in informal sector based mainly on tacit experiential knowledge, while science, technology and innovation is dominant approach in formal and academic sectors innovation based on explicit knowledge (Jensen et al., 2007). Formal sector and academia also use DUI more formally and systematically but less frequently. Most formal sector technology development methods focus on explicit knowledge except knowledge management methods which emphasize both by focusing on conversions between tacit and explicit forms. Informal sector can benefit by borrowing DUI theories from formal and academia.

Some informal sector theories and methods have been developed in regions outside Africa, but African informal sector remains without theory and a methodical. The study objective was to find ways of adopting and adapting theories and methods from similar domains for African informal sector technology development and innovation.

Design and knowledge management

Design develops a high-level solution structure and then details it to level it can be implemented as a concrete solution. Failure is a learning opportunity. Even if design fails important lessons are learned for developing current and future design solutions (Campbell, 2017). Innovation journey is from failure to failure until enough is learned to innovate. Ordinary people in developing countries play the role of lay designers driven to innovate and design by poverty, inequality and unmet needs in contexts professional designers solutions are not appropriate (Campbell, 2017).

Foreign professional designers sometimes create solutions not compatible with local values, while local designers create compatible unaffordable solutions while lay designers create low-cost, low-quality solutions. Countries are marching forward towards becoming knowledge-based societies. Developing countries informal sector must become more knowledge based to contribute to knowledge-based societies. Appropriate technology (AT) movement should be driven by local people where professionals are technical assistants rather than directors of technology development programs (Sianipar et al., 2013).

AT movement should embrace indigenous knowledge, experience and simplicity-based strategies. AT design methodology consist of planning stage where gatekeepers who act as knowledge sources and can support design, concept creation stage scales up creativity, designing, testing and assessing stage determines appropriateness of product (Sianipar et al., 2013). Gatekeepers who are able to influence adoption of knowledge and technology to bring changes to artisan attitude of adopting as they are good knowledge sources.

A study found there is little new knowledge filtering to informal sector from outside because, of few interactions/linkages between formal sector and little internal knowledge development resulting in little growth of informal sector knowledge base (Wangare, 2015). In current times external knowledge is critical for growth of any sector as vast amount knowledge and experiences are created outside any firm than inside. Informal sector is driven predominantly by tacit knowledge and experiential knowledge and failure to keep lessons learned is hindrance to future learning. Knowledge flow between artisans and from outside is a catalyst for innovation.

Maker movement

Developing countries informal technology developing sector are part of maker movement. Maker movement is based on do it yourself by deviating from formal production process, is local, informal and individual scale production (Bonvoisin et al., 2017). Deviating is due to lack of capabilities, resources or constraints that prevent using best approaches by improving to get a solution that is good enough to be sold.

Community based maker movements don't originate from organizational or institutional initiatives (Kraemer-Mbula and Armstrong, 2017) indigenous makers can create informal sector community innovation maker movements to create and share knowledge for creating new technologies through prototyping and experimenting. University maker movements are based on volunteer experts and students who are paid stipends, are usually given general equipment to use for free but pay small amounts to pay specialized equipment (Kraemer-Mbula and Armstrong, 2017). Universities can experiment with different combinations of resources to discover most suitable combinations for maker movement in their context.

The maker or do it yourself grassroots movements have potential to provide more appropriate and progressive theories because they closely integrate local and global knowledge. The African informal sector has enterprises utilizing knowledge across the spectrum from indigenous to global knowledge. There has been Faire maker movements gatherings in Accra in 2009, Nairobi in 2010, Cairo in 2011, Lagos in 2012 and Johannesburg in 2014 (Kraemer-Mbula and Armstrong, 2017) indicating that other maker movements are diffusing into Africa. This will result in diffusing of associated, experiences and techniques.

Ghanaian maker platform is based on indigenous research and development with orientation that African problems should be solved using transdisciplinary, co-design methods with African design solutions (Potter et al., 2019). Transdisciplinarity unifies global knowledge from different disciplines and indigenous knowledge. Advantages of using indigenous knowledge are ability of large number of people to contribute, wide available of knowledge, its being cheaper to acquire and assimilate by locals. Africans developing and implementing design solutions build design and implementation capabilities.

There is an African proverb borrowed things cannot satisfy ones needs. Borrowed solutions are useful but it not possible to solve all your problems by borrowing. There are few borrowed solutions that are free. Informal sector knowledge borrowing should be supported by a philosophy that crosses many disciplinary boundaries and community perspectives and creates solutions that reposition African culture and collectivism as driver for African strengths and utilization of opportunities (Potter et al., 2019). Design seeks different alternatives based on diverse perspectives.

Jugaad is design and design is Jugaad (Beniwal, 2016) is a transdisciplinary duality pointing to grassroots movements being transdisciplinary. Design thinking has been in use for over 50,000 years (Shneiderman, 2017) has been embedded in human culture, is thus a good starting point for systematizing informal sector design. Exploration of design-oriented approaches and attempts to adopt design are promising trajectories.

3. BORROWING THEORIES AND TECHNIQUES PROCESS

Having a well-defined process of borrowing entities from other domains, disciplines and sectors ensures best practices and experiences are captured, followed, shared and process can be continuously improved. The process used to do this research was distilled and codified and presented in (Figure 1).
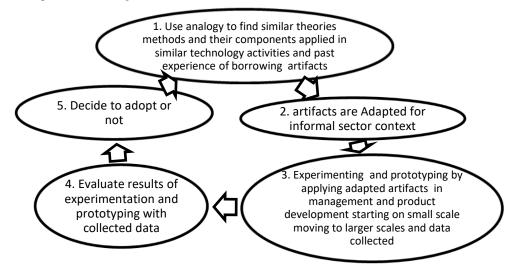

Figure 1 Theories and method borrrowing process cycle

The process will use Analogy to find similar artifacts (theories and methods) and their components used in similar activities in industry, academia or other informal sector from same and other countries. The found artifacts are adapted to ensure they fit local context. Informal sector enteprises experiment and prototype with adapted entities through production and data is collected. Collected data is used to evaluate artifacts for assessment of whether there are better better than previous means. Based on results of evaluation decision is made to adopt the artifacts or not.

4. DISCUSSIONS

Follower strategy of utilizing knowledge spillover from world technology leaders reduces cost of catch-up. Informal sector can learn from other sectors that possess knowledge, theories and methods they need by borrowing and applying. Concepts and principles are building blocks of theories and methods and informal sector can borrow them then combine them in different ways in addition to adding informal sector concepts and principles. For a country, industry or sector to catch-up it must increase proportion of population with technical skills must be 50% or more (Wamae, 2006). It is faster and cheaper to upgrade the informal sector to help build innovation critical catch-up mass by borrowing relevant artifacts and applying them than by training equivalent mass of modern educated professionals.

Some people in informal sector are not likely to have time for formal training as they earn their livelihoods by full time informal sector activities while others can't afford. To integrate informal sector specializing in indigenous knowledge and technology national innovation system can assist in acquiring the relevant external artifacts to upgrade the sector. Since informal sector technology training comes from learning from doing and innovating (Kumar and Bhaduri, 2014) providing sector with better knowledge-based artifacts is one way of accelerating the sector towards becoming a knowledge-based sector. The cheapest and fastest way to do this is to borrow artifacts already developed and use them in practice.

5. CONCLUSION

African Informal sector adopting artifacts they need from formal sector and other grass movements can trigger drastic improvements in sector that is lagging behind other grass movements due to insufficient funding, educational and institutional support. Borrowed concepts and principles can be used to build sector specific theories, methods and techniques which are necessary for growth of sector to a more systematic informal sector, an important step towards becoming an informal engineering and design sector. Borrowed relevant knowledge and artifacts can be adapted and immediately used in practice.

According to advice by an African proverb borrowed things cannot satisfy ones needs so borrowing must be combined with or lead to developing sector specific theories and methods. Future research should explore developing informal sector specific theories

Other Authors details
Adjunct lecturer, United States International University.

REFERENCES AND NOTES

1. Beniwal B. Jugaad as Design, Design as Jugaad 2016. https://www.academia.edu/27090013/Jugaad_as_Design_Design_as_Jugaad

2. Bonvoisin J, Galla JK, Prendeville S. Design principles for do-it-yourself production. In Sustainable Design and Manufacturing. Springer International Publishing 2017; 68:77-86.

3. Camburn B, Viswanathan B, Linsey J, Anderson D. Design prototyping methods: State of the art in strategies, techniques and guidelines. Des Sci 2017; 3:E13.

4. Campbell AD. Lay Designers: Grassroots Innovation for Appropriate Change. Des Issues 2017; 33(1):30-47.

5. Dufva T. Maker Movement creating knowledge through basic intention. Tech Ser A 2017; 24(2):129–141.

6. Foster C, Heeks R. Conceptualising Inclusive Innovation: Modifying Systems of Innovation Frameworks to Understand Diffusion of New Technology to Low-Income Consumers. Eur J Dev Res 2013; 25:333–355. doi: 10.1057/ejdr.2013.7

7. Gero JS. Research Methods for Design Science Research: Computation and Cognitive Approaches, Unpublished Manuscript, Sydney University 2000.

8. Hargadon A. How Breakthroughs Happen, Harvard Business School Press 2003.

9. Jauhiainen JS, Hooli L. Indigenous Knowledge and Developing Innovation Systems: The Case of Namibia. Int J Innov Stud 2017; 1(1):89–106.

10. Jensen MB, Johnson B, Lorenz E, Lundval BA. Forms of Knowledge and Modes of Innovation. Res Policy 2007; 36:680–693.

11. Jiménez A. Inclusive innovation from the lenses of situated agency: Insights from innovation hubs in the UK and Zambia. Innov Dev 2018; 9(23):1-24.

12. Juma C, Clark N. Technological catch-up: Opportunities and challenges for developing countries. SUPRA Occasional Paper, Research Centre for the Social Sciences, University of Edinburgh 2002.

13. Kaplinsky R, Chataway J, Clark N, Rebecca H, Kale D, Muraguri L, Papaioannou T, Robbins P, Wamae W. Below the Radar: What does Innovation in Emerging Economies have to offer other Low-Income Economies? UNU-MERIT United Nations University 2010.

14. Khaing MM, ThetSu A, Thant KS, Aung TT, Tin HHK. Learning on the Smart Campus Information System. Discovery 2022; 58(318):597-602

15. Kidenda MC. Enhancing Design Practice and Planning in the Jua Kali Sector through a Competency-Based Design Training Framework, Proc 2nd Arts Educ Commun Engage Conf 2019.

16. Kraemer-Mbula E, Armstrong C. The Maker Movement in Gauteng Province, South Africa, Working Paper 6. Open AIR Afr Innov Res 2017.

17. Kumar H, Bhaduri S. Jugaad to grassroots innovations: understanding the landscape of the informal sector innovations in India. Afr J Sci Technol Innov Dev 2014; 6(1):1-10.

18. Kumar H. Publication Trends in the Informal Sector Innovation Research. J Scientometric Res 2020; 9(2):5-13.

19. Maina SM, Rukwaro RW, Onyango WH. Infusing design in the Jua Kali (informal sector) production processes. IOSR J Humanit Soc Sci 2017; 22(3):1-12.

20. Potter C, Osseo-Asare DK, M'Rithaa MK. Crafting spaces between design and futures: The case of the Agbogbloshie makerspace platform. J Futures Stud 2019; 23(3):39–56.

21. Premaratne SP. Entrepreneurial Networks and Small Business Development: The Case of Small Enterprises in Sri Lanka, PhD thesis, Eindhoven University of Technology 2002.

22. Sethi R, Duque CD, Vencatachellum I. Designers Meet Artisans: A Practical Guide. Craft Revival Trust, New Delhi 2005.

23. Shaw M, Garlan D. Software Architecture: Perspectives on an Emerging Discipline. Prentice-Hall 1996.

24. Shneiderman B. The new ABCs of research: Achieving breakthrough collaborations. Oxford University Press 2017.

25. Sianipar CP, Yudoko G, Dowaki K, Adhiutama A. Design Methodology for Appropriate Technology: Engineering as if people mattered. Sustainability 2013; 5:3382-3425.

26. Tams S. On the appropriateness of theory borrowing in IS: An interdisciplinary evaluation. Proc South Assoc Inf Syst Conf 2010; 130-135.

27. Ustyuzhantseva O. Institutionalization of grassroots innovation in India. Curr Sci 2015; 108(8):1476-1482.

28. Ustyuzhantseva O. Studies of inclusive innovation in socio technical systems: Case studies in Russia and India. Innov Dev 2017; 7(1):83-100.

29. Wamae W. Why Technological Spillovers elude Developing Countries: A Dynamic Non-Linear Model. DRUID 2006.

30. Wangare BJ. Knowledge Management in the Informal Sector: A Review of Kenya's Jua Kali Industry. Int J Econ Commerce Manag 2015; 3(10):257-278.