

## Chapter 9

### *African universities and connectedness in the information age*

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In China Miéville's *The City and The City*, the cities of Beszel and Ul Qoma co-exist in the same geographical space and in the same time continuum. In both cities, the citizens' complicit but voluntary perception of separateness sustains their cleavage. Citizens are socially programmed to 'unsee' the inhabitants, buildings, machines and urban furniture of the other city, and to cross over without sanction is to 'breach', invoking punishment meted out by the eponymous oversight authority that is a law unto itself. Movement from one city to another is permitted, but is subject to authorisation, and entry is controlled via a shared border-crossing at The Copula Hall. The Copula is a switch of sorts, allowing passage from one social order to another across a shared physical space.

Manuel Castells postulates the 'discovery of a new social structure in the making, [...] conceptualised as the network society because it is made of networks in all the key dimensions of social organisation and social practice' (Castells 2010: xviii). In Castells's network society, structurally different from previous networks because of the advent of digital information and communication technologies, space and time collapse to create a new space of flows while, simultaneously, citizens search for meaning in their local realities. In such a society, and particularly for those global citizens who occupy key social institutions,

universities included, switching between networks can be both complex and contradictory.

While previous chapters in this collection have paid attention to the role of the university in Africa, and placed particular emphasis on their aspirations to become research intensive within a quadrant of competing historical functions described by Castells, this chapter explores with reference to Castells's narrative of the network society how universities are connecting in an increasingly digitally networked world to meet their objective of producing new knowledge while simultaneously meeting the expectations of their relevance to society.

This chapter is therefore a modest attempt to extend Castells's theory of the network society by exploring the possibility of different types of connectedness in university networks. It does so by examining the connections university academics make in different networks, proposing a particular type of connectedness in operation at universities, and by showing that the directionality of connections between nodes matters for development. The focus is on two African universities as key social institutions in the production and dissemination of new knowledge in a globalised world.

### *On networks in the Information Age*

Networks as a form of organisation is neither new nor disruptive; it is the advent of digital networking technologies in the information age that gives rise to the network society, a society whose social structure is determined by networks activated by digital information and communication technologies (Castells 2009). Digital networks are therefore the axis on which the reorganisation of society's constitutive processes turn, shifting from hierarchical flows of information to the processing of flows of information that are global, horizontal, reflexive and indifferent to historical notions of communications across time and space.

From the global digital network emerges a new form of spatiality, the space of flows: 'the material support of simultaneous

social practices communicated at a distance. This involves the production, transmission and processing of flows of information. It also relies on the development of localities as nodes of these communication networks, and the connectivity of activities located in these nodes by fast transportation networks operated by information flows' (Castells 2010: xxxii). While the network is therefore global, the nodal 'localities' retain their importance as geographically defined sites for the location of local, place-specific, face-to-face micro-networks. Castells emphasises the inherent contradiction between the space of flows and the space of places. In the network society, cultural and social meaning is defined in place terms, while functionality, wealth and power are defined in terms of flows.

In the Castellan conception of the network society two separate but interacting processes prevail: the mode of production and the mode of development. The mode of production constitutes the production of goods and services in specific social relationships, driven historically by capitalism. The mode of development is constituted by those technological arrangements through which labour acts on matter to generate products and evolves according to its own logic, which is predominantly predicated on the interaction between scientific and technological discovery (see also Chapter 2: 24–25 above). According to Castells, economic development and technological development are necessarily separate processes because technological development is also driven by non-economic considerations such as invention and experimentation. The outcomes of inventiveness and experimentation may or may not be taken up by society.

It is not only the modes of production and development that are distinct in the network society; multiple, distinctive networks exist, each with their own geography and their own logic: 'the most strategically important observation for an analysis in terms of spatial networks is that these global networks do not have the same geography; they usually do not share the same nodes. [...] Political agencies, nationally and internationally, build their own spatial sites and networks of power. The global network of scientific

research does not overlap with the networks of technological innovation' (Castells 2010: xxxviii). Each network is defined by a programme, formulated by social actors, that assigns to a network its goals and its rules of performance (Castells 2009: 20).

Distinctive networks may compete with one another but they may also cooperate. Cooperation depends on the connectedness between networks and is made possible by introducing interoperability via shared protocols and languages/code, or by the presence of switches (connecting points).

*On the African university in the Information Age*

The trajectory of the African university as a social institution in terms of its historically-determined functions and its relationship with society has already been described (see Chapter 6). What is clear is that the contemporary African university must grapple with competing demands, both exogenous and self-imposed.

According to Castells, African universities must take seriously their scientific function of knowledge production: they 'must also emphasise research, both basic and applied, since this will become the necessary ground for upgrading the country's productive system' (Chapter 3: 49) and '[w]ithout the self-determination of the scientific community in the pursuit of the goals of scientific research, there will be no discovery' (Chapter 3: 47–48). However, in a world where trust between society and its public institutions is waning (a point made by Castells in Chapter 5 above), academics are increasingly expected to engage with those beyond their ramparts and, in doing so, they are expected to become relevant and responsive to the needs of society. Castells is attuned to the social pressures that universities face: 'But universities as organisations are also submitted to the pressures of society, beyond the explicit roles they have been asked to assume, and the overall process results in a complex and contradictory reality' (Chapter 3: 41).

Responding to the needs of society is often framed under the banner of 'university–community engagement' or of its 'third mission'. Typically, the notion of 'engagement' (or 'third mission')

is used to denote the university's closer relationship with the market and/or society in order to meet the needs of society; a relationship imposed on the university by society as it expects the academy to find solutions to the challenges it faces.

Such engagement is normative, an activity to be undertaken by academics that is inherently good for society. But proponents of engagement rarely consider the academic dividends for the university, that is, the scientific returns from its engagement with society (other than, from a scientific point of view, the relatively lower returns of higher levels of transparency and accountability to external stakeholders). And the engagement literature fails to acknowledge that these returns to the university are not necessarily (narrowly) self-serving – it is the academic dividends that accrue to the university that place the university in a stronger position to contribute to social and economic development.

Key then to the relationship between higher education and development is the establishment of a productive interaction between the university's knowledge enterprise and its engagement activities. An overemphasis on the basic knowledge activities of teaching and research – in other words, a predominantly inward orientation – risks the university becoming disconnected from the needs of society. However, an overemphasis on connecting to those external to the university potentially leaves the university with little new knowledge to foster innovation and fuel development. The challenge for universities is to manage this inherent tension between 'buffering' (protecting) the core technologies of the institution and 'bridging' (linking) those with external actors (W. Scott 2001: 199–211). In the words of Castells (Chapter 3: 42):

The real issue is not so much to shift universities from the public arena to secluded laboratories or to capitalist board meetings, as to create institutions solid enough and dynamic enough to withstand the tensions that will necessarily trigger the simultaneous performance of contradictory functions. The ability to manage such contradictions, while emphasising the role of universities in the generation of knowledge and the

training of labour in the context of the new requirements of the development process, will condition to a large extent the capacity of new countries and regions to become part of the dynamic system of the new world economy.

There are network dynamics at play here. On the one hand, the university is required to be part of the global network of science if it is to participate in and add value to the flows of network-specific information that will advance knowledge and yield new discoveries:

[B]ecause we are in a global economy and in a global research system the notion of universities being stand-alone, major research centres is gone. The critical thing is to be in the networks of global production of knowledge, of research and innovation. [...] You need to have a ticket to enter one of the networks; you have to provide something that is not necessarily the best in the world but is interesting enough that all the other participants in the global research network of one particular field want you to be in the network. (Chapter 4: 60)

In this sense, it is less about participation than about universities in Africa being included or excluded because the university as a key institutional component of science (in turn, one of the dominant functions in the network society) is organised around the space of flows.

On the other hand, the university must negotiate entry into and foster links in new socially relevant and representative networks. This requires the university to position itself in place-based local networks that first, are distinct from the global network of science and second, are of different kinds (of industry, entrepreneurs, law-makers, neighbourhood communities, and so on). Noting the challenges at the system and organisational levels of managing these contradictions effectively, for academics at African universities who have historically been on the margins of global knowledge production and who are increasingly expected to contribute to national development, engaging with those external

to the university in such a manner so as to ensure the creation of knowledge valued by the global scientific community is equally challenging. They must both cultivate the non-scientific networks that will allow them to engage, and maintain their position in global scientific networks by ensuring that they have something of value to offer.

In sub-Saharan Africa, in a context of relatively underpaid and poorly incentivised permanent academic staff, engaged research – that is, research of the kind that situates itself in stakeholder networks rather than exclusively in scientific networks – is often synonymous with consulting work. And there are those who warn of the dangers of such engaged research becoming dislocated from the academy and from home-grown development prerogatives and strategies as researchers bend to the research prerogatives of government and international funding agencies (Cloete et al. 2011; Mamdani 2016; Mkandawire 2011).

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The above brutal truncation of the network society and the position of the African university, brings to the fore a least two lacunae. The first is that Castells is not specific when it comes to the variety of types of connections made between networks. Shared protocols, code and switches make interoperability possible, but what does cooperation between human networks look like? Being engaged requires academics to connect between two or more different networks: each with distinctive geographies, mega-nodes and logics. For universities, at least two types of networks emerge in the information society: networks that are global and predominantly focused on making connections within the science community to support knowledge production; and networks that are predominantly more local and focused on the provision of solutions in response to the needs and demands of local communities. In other words, there are, for universities, specialised and non-specialised connections to be made – specialised connections between academics, within a globalised

academy; and non-specialised connections between academics and predominantly local stakeholders external to the academy.

The second lacuna is that while Castells acknowledges that networks, particularly global digital networks, accelerate infinitely the speed at which information is exchanged, he offers little by way of the velocity, that is, the speed at which information travels in a given direction. In other words, his networks are not specific about the direction of information flows, nor are they specific about the direction in which value travels between nodes in networks.

It is these creases within the grand narrative that this chapter explores. The empirical basis for the explorations is a study by Van Schalkwyk (2015) that sought to examine more closely the impact of university–community engagement projects at two African universities; specifically, the contribution that university–community engagement made to strengthening the core functions of knowledge production (research) and teaching (knowledge transfer) at those universities. Whether the engagement activities of university academics were strengthening the academic core was taken as a proxy for the extent to which those academics are able to manage the tension between supporting the core functions of the university and the pressure for their academic activities to be relevant and responsive to society. Where necessary, the discussion is supplemented by data from additional sources.

The two universities included in the study were Nelson Mandela Metropolitan University (NMMU) located in Port Elizabeth, South Africa, and Makerere University located in Kampala, Uganda. Makerere University is positioning itself as a research university and there is evidence of early successes in moving in that direction if the number of research articles published is used as a proxy for research output (Bunting et al. 2014), while NMMU is a comprehensive university which, in South African terms, implies a mix of both research and teaching in its strategic focus. Makerere relies largely on funding from donor agencies to fund its research (Makerere University 2013) while NMMU has a history of close links with the automotive and other regionally-located industries. These variances were deemed to make each

university a potentially informative case to explore how academics are navigating the tension inherent in university–community engagement.

### *Spaces*

Castells points to the contradiction between the space of flows and the space of places in the network society. He also recognises the presence of multiple networks, each with its own geography and value logic. The study of university–community engagement, with its dual interest in the connections university academics make to the academic core of the university (where the university is a potential node in the globalised network of science programmed around the production of knowledge and discovery), and to the communities external to the university (where the university is a potential node in local networks programmed around solving the problems faced by specific communities), provides empirical evidence to explore how academics are pivoting around the university as a switching node in multiple networks.

An examination of the location of university–community engagement projects at NMMU,<sup>1</sup> in other words, their sites of implementation, shows that the execution of projects is almost exclusively local, that is, within either the city, region or country in which the university is located. Data on the location-specificity of 76 university–community engagement projects at NMMU show that 12 (16%) projects indicated South Africa as the site of implementation; 10 (13%) the Eastern Cape Province; 20 (26%) Nelson Mandela Bay Metropolitan Municipality; 7 (9%) a specific precinct or suburb within the Metro; and 2 (3%) indicated that the university campus was the site of implementation.<sup>2</sup> Only 4 (5%) projects indicated that project implementation was at the international level, which is not to suggest that these projects are any less place-based than those with a more local site of

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1 The analysis in this instance is limited to NMMU because of its larger sample size.

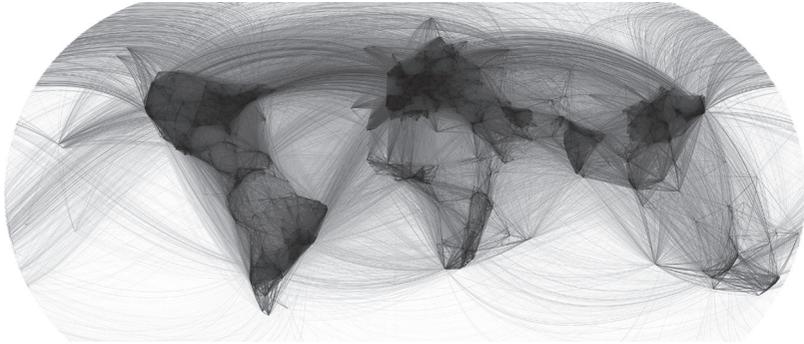
2 The remainder of the projects (18%) provided no site of implementation.

implementation. The obvious point here is that these engagement activities undertaken by academics at NMMU are place-based, and that this requires academics to enter into local, micro-networks in order to connect to relevant actors in the community in a quest for relevance.

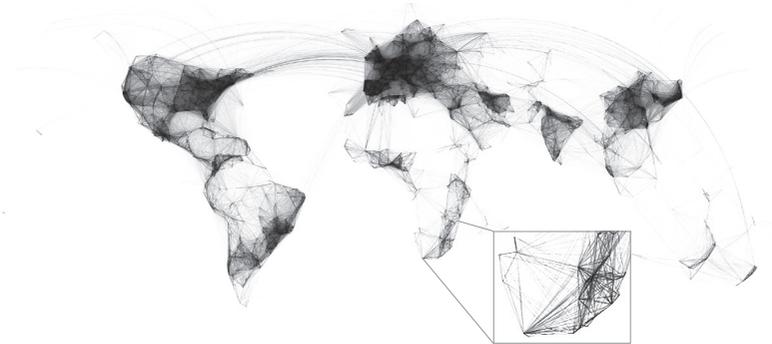
At the same time, academics are required to participate in and contribute to the flow of information in the global network of science. Figure 1, using data on the co-authorship of journal articles indexed in Scopus between 2008 and 2012 to create connections between the cities in which authors are located (Beauchesne 2014), reveals three insights. The first is the existence of mega-nodes in the globalised scientific network (highlighted in Figure 2 by adjusting the contrast of Figure 1), determined by the presence of what Castells would term ‘powerful’ universities on the US East Coast, in the UK, in Northern Europe and in Japan, and, to a lesser extent in Brazil and India. The second is that the connections between mega-nodes on either side of the Atlantic are most prominent. In the cases of Brazil, India, Japan and China, connections are between authors in the same country – partly, but not only, because of co-authors publishing in a language other than English. The third insight is the relatively insignificant contribution by NMMU, notably in relation to the relatively more central nodes of Cape Town and Gauteng in the same country. At face value, it would therefore appear that academics at NMMU are connected both to local networks as a requisite for engaging with local actors and to the globalised network of science, but only marginally so in the latter instance. According to Castells: ‘the more organizations depend, ultimately, upon flows and networks, the less they are influenced by the social context associated with the places of their location. From this follows a growing independence of the organizational logic from the societal logic’ (Castells 1989: 169–170). It would appear that such an organisational transition is yet to materialise at NMMU, and most likely also at other African universities, including Makerere University, attempting to manage the tension between national development priorities (relevance) and participation in global science.

A deeper understanding of these dual network connections and how academics at two African universities pivot around these shared nodes, is explored in the section that follows on interconnectedness.

*Figure 1: Global collaboration between researchers (2005–2009)*



*Figure 2: Mega-nodes in science based on global scientific collaboration*



### *(Inter)connectedness*

The study by Van Schalkwyk (2015) operationalised university–community engagement (and the management of the inherent tension) as ‘interconnectedness’. Framing university engagement as interconnectedness makes possible the exploration of a particular type of connectedness in the network society. The study defined

interconnectedness as ‘the relationship (in tension) of academics engaging with those outside of the university while simultaneously linking back to the university’ (Van Schalkwyk 2015: 205).

Interconnectedness was operationalised along two dimensions. The first dimension is ‘articulation’, which has a number of characteristics. First, articulation includes the extent to which the aims and outcomes of engagement activities articulate with the university’s strategic objectives. Second, articulation factors in the degree to which projects were self-determined or steered by the interests of external stakeholders. Third, articulation includes the linkages that engagement activities have with external stakeholders such as government, industry, small businesses, non-governmental organisations and others. An additional link is the extent to which there are connections with an ‘implementation agency’ (i.e. an external body which takes up the knowledge and/or its products generated or applied through research or training). Fourth, articulation takes into account linkages generated through sources of funding in three respects: whether the engagement activity has obtained external funding; the number of funding sources secured; and the extent to which the project developed a relationship with its funders over time.

Seen as a type of connectedness, the articulation indicators are all of a type that are *inside-out* connections. Given that the project as an organised set of activities is the unit of analysis, engagement takes place within the university as a complex organisation with both vertical arrangements (university management and the faculties or schools below it) and horizontal arrangements (the number of autonomous disciplines arranged into faculties or schools) (Clark 1983). Articulation therefore not only includes inside-out connections between the project and those communities outside of the university but also inside-out connections from the project to the host university’s structural and symbolic components (the strategic objectives formulated by management and the academic imperatives formulated by peers).

The second dimension of interconnectedness incorporates the extent to which engagement activities serve to strengthen

the academic core of the university. According to Clark (1998), when an enterprising university develops an outreach structure, its academic departments, formed around disciplines and some interdisciplinary fields, remain the heartland of the university; the heartland being where traditional academic values and the day-to-day activities such as teaching and research take place. Instead of 'heartland', Van Schalkwyk (2015) used the concept 'academic core' developed by Cloete et al. (2011; see also Chapter 7 above). In Castellan terms, the academic core consists of the mutually dependent education and scientific functions of the university (see Chapters 2 and 3 above). The university as a service provider to the community risks restricting its contribution to the application of existing knowledge in lieu of the production of new knowledge and is, consequently, likely to make only a marginal, short-term contribution to development.

Academic core indicators include the extent to which the engagement activity generates new knowledge (versus applying existing knowledge) using publications and patents as proxies; feeds into teaching or curriculum development; is linked to the formal training of students; enables academics to disseminate their research; and is linked to international academic networks. These indicators are all of an *outside-in* type of connection.

The various aspects relating to 'articulation' and 'strengthening the academic core' were converted into a set of eight indicators which could then be applied to an analysis of the engagement activities included in the study. Four indicators were developed for each of the dimensions to ensure an equal weighting between the articulation and the academic core indicators (see Table 1 in Appendix 3). On the basis of the indicator score totals for articulation and for the academic core, the projects were plotted on a graph depicting the intersection between 'articulation' and 'strengthening the academic core' in order to provide a graphic representation of each project's interconnectedness. Interconnectedness is represented on a third axis, which bisects the articulation and academic core quadrants, and which ranges from disconnected (-9) to interconnected (9).

The articulation, academic core and interconnectedness scores for each of the two African universities in the study are presented in Figures 3 and 4.

Projects at both universities scored higher on the articulation indicators than on the academic core indicators. A closer examination of the articulation scores reveals that projects at both universities scored well in terms of the project initiation and agenda-setting indicators. However, on average, projects scored relatively poorly when it came to the other articulation indicators.

Engagement project scores were low at both universities in terms of their links to specific institutional strategic objectives, as expressed in each university's mission and vision statements. At NMMU, the data show that projects mostly linked to between one and three of the institutional objectives, most often to NMMU's commitment to regional development. By contrast, the data show that NMMU's strategic objective of contributing to both African and global development was consistently absent from the objectives of the university's engagement projects. An analysis of funding sources shows that firms located in the region, as well as funding from the province and the city, made up the bulk of the project funds at NMMU. It would appear, therefore, that for project leaders the local reality in which a project operates trumps the continental and global aspirations of the university.

In the case of Makerere University, the data show that, on average, projects linked to at least two of the university's strategic objectives. As in the case of NMMU, responsiveness to global challenges was rarely cited as a project objective at Makerere University, and most projects indicated an aspiration to respond to national needs (rather than regional needs, as was found to be the case at NMMU). Unlike NMMU, projects at Makerere University relied more heavily on funds from foreign donors, with limited funding from government or industry. Perhaps the finding that NMMU's engagement activities are regionally focused while Makerere University's are nationally focused, is unsurprising given Makerere's position as a national flagship university, while

Figure 3: Interconnectedness at Makerere University (n=22)

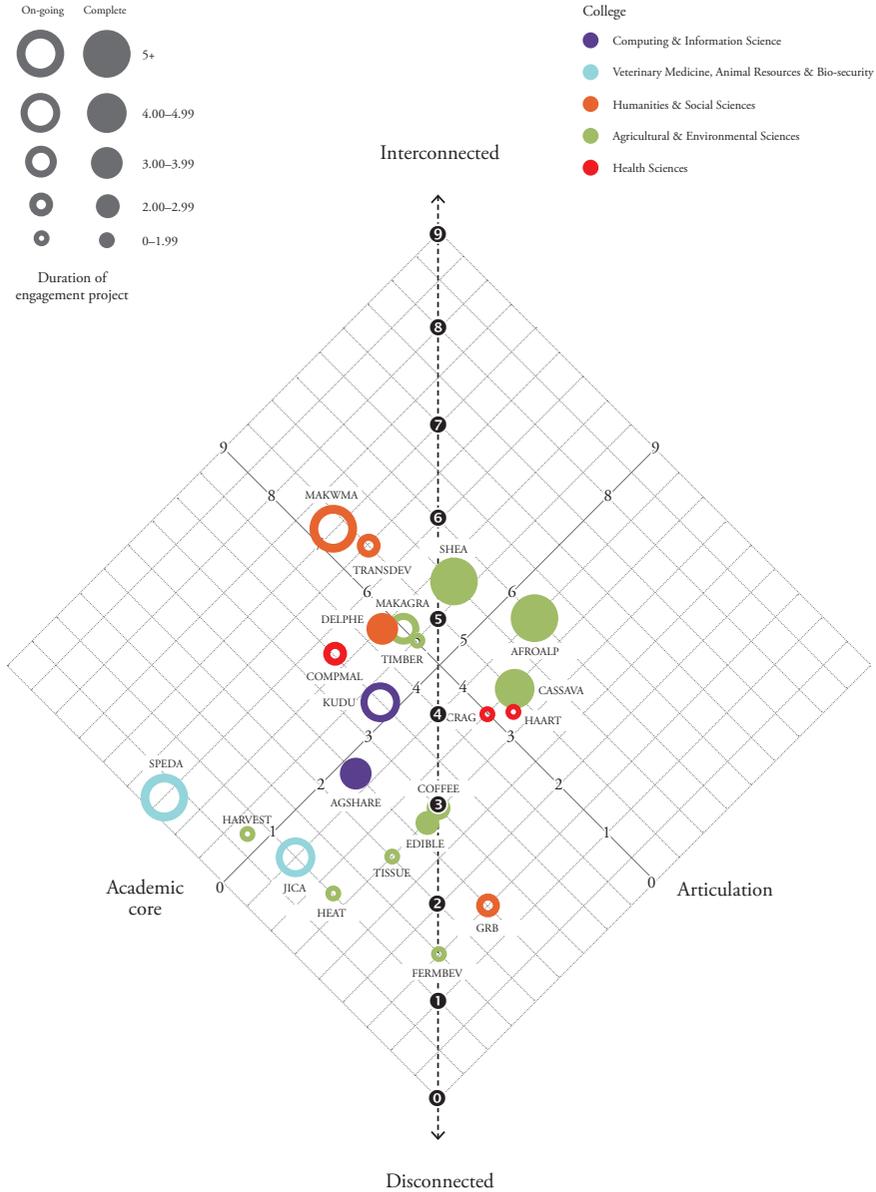
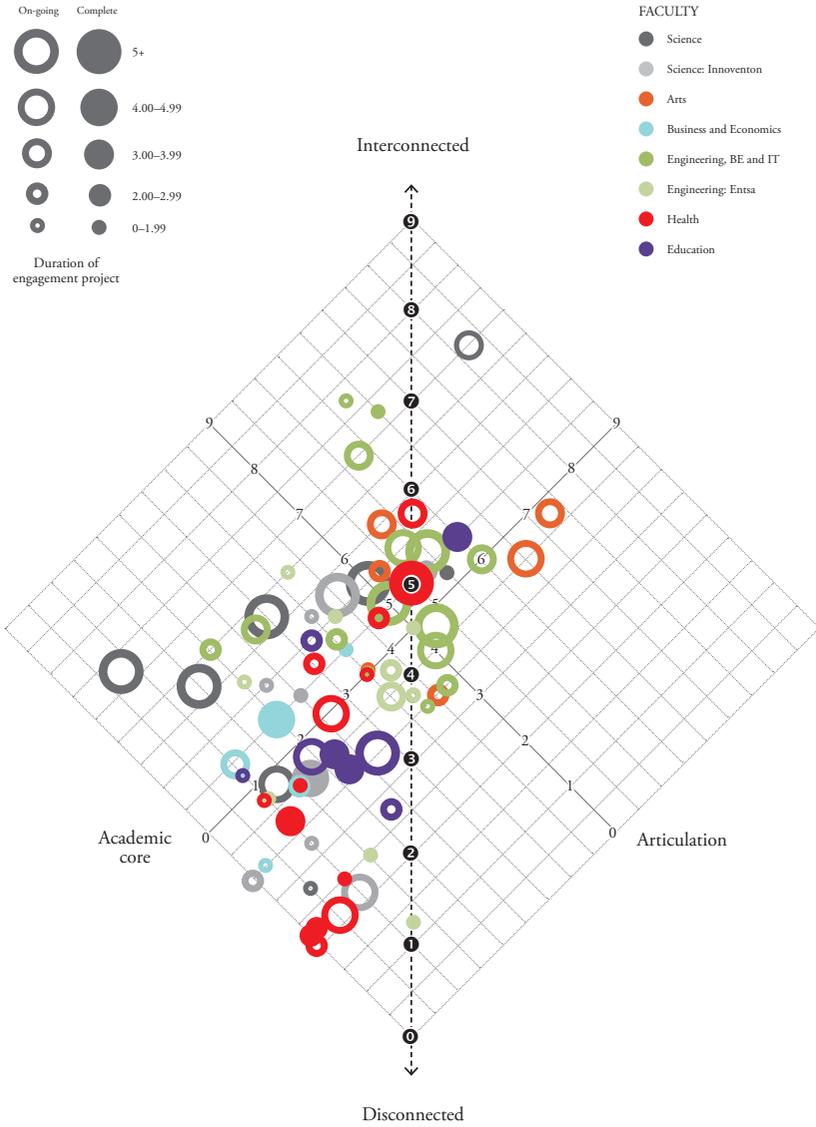


Figure 4: *Interconnectedness Nelson Mandela Metropolitan University (n=77)*



NMMU fulfils a more regional developmental role within its national higher education system.

In the case of external linkages, the scores indicate that, on average, projects at both universities linked to only one external constituent other than the project's funders. This would appear to indicate a tendency to focus engagement activities on a single constituency, in so doing creating a binary relationship between the university and the external constituent, rather than a more networked approach to engagement activities in which multiple stakeholders are active. However, it could also indicate that academics are connecting to a central node in a specific network. The centrality of the node negates the need to connect with other nodes. The specificity of the network points to the location of value in one network that may be absent in other non-scientific networks.

The academic core indicators reveal which projects are high producers in terms of the production, transfer and dissemination of *new* knowledge. From a different vantage point, the academic core indicators also reveal which projects are not linking the knowledge created (assuming such knowledge has indeed been created) to the academic core, even if they are engaging successfully with those external to the university.

At Makerere University, projects scored relatively well in terms of knowledge creation, the availability of knowledge in the public domain and linking to PhD programmes. Projects at Makerere University scored less well in terms of how they linked to teaching and learning activities at the university. Of concern at NMMU is the fact that, on average, projects did not generate new knowledge. Weighing down NMMU's scores to some extent is the fact that much of the knowledge created by its community engagement projects was not publicly available. In particular, many projects at NMMU (24%) received funding from industry, with embargoes being placed on the dissemination of proprietary knowledge. This restricts the flow of information to private networks, and while these networks may nevertheless be global, the flow of information is more likely to be vertical rather than horizontal as would be the case if the information were to be made publicly

available. Makerere University, in contrast, scores much better on the public availability of knowledge. Given that in the case of Makerere University, project funding came predominantly (78%) from foreign donors who value and even contractually require the openness and accessibility of the knowledge produced, public access is to be expected. The study did not go so far as to determine the quality of the knowledge produced (using, for example, citations as a proxy for quality). Without a quality indicator, it is not possible to speculate about the value of the publicly available knowledge produced and, consequently, whether such publicly available knowledge would propel Makerere University's position in global scientific networks.

With some exceptions, projects that scored lower on the academic core indicators tended to be projects that were ongoing rather than complete. Certainly, in the case of Makerere University, it is evident that completed projects scored better on the connectedness axis than did ongoing projects. In fact, the samples at both universities tended to have a preponderance of ongoing projects. Given that many of the engagement activities in the sample were still in the early phases and given the time-lag in the academic publishing process, these ongoing projects retain the potential to score more highly on the academic core indicators as they mature. This highlights the importance of not only producing snapshots of university engagement activities at a particular moment in time, but also of tracking engagement activities over a longer period in order to observe possible improvements in linking engagement projects to the core functions of the university.

### *Disciplinary valency*

In the field of chemistry, the valency of an element measures its ability to combine with other elements. Following Clark's (1983) conception of the independence of scientific disciplines from one another for their survival, it is conceivable that engagement may prevail and thrive within one discipline without any impact on another discipline. In other words, projects in different disciplines

within the same university can be more or less interconnected, and the disciplinary ‘charge’ of a project may have a bearing on its valency, that is, its ability to combine with external ‘elements’ to create (inter)connections between scientific and non-scientific networks.

Mindful of this possibility, the study by Van Schalkwyk (2015) included a disciplinary dimension in the data collected in order to capture the disciplinary convergences and variances of the engagement projects studied. In the case of disciplines that claim to be unsuitable for the engagement enterprise, the intention of adding a dimension for discipline or field of study was not to expose those disciplines that are failing to engage, but rather to identify what can be learnt from projects that appear to be doing so successfully regardless of their perceived disciplinary engagement encumbrances. Moreover, a differentiated picture of university–community engagement by discipline would be a first step towards defining different engagement criteria for projects and their respective academic units across the university.

Figure 3 shows that engagement projects at Makerere University are evenly spread across the middle of the interconnectedness spectrum. However, projects in the sample from the College of the Humanities and Social Sciences, and from the College of Agricultural and Environmental Sciences, appear to be the most successful in mediating the tension between linking both externally and with the academy. Projects from the College of Veterinary Medicine, Animal Resources and Bio-security and, to a lesser extent, from the College of Computing and Information Science, appear to be struggling to link their engagement with external communities to the core functions of the university.

At NMMU, Figure 4 shows that the Faculties of the Arts and of Engineering appear more capable than other faculties at the university in managing the tension between engaging externally and strengthening the core. While the Faculty of Health has some projects that score between 4 and 6 on the interconnectedness axis, it also houses several projects (mainly from the Department of Nursing) that populate the disconnected end of the spectrum,

mainly owing to poor academic core ratings. This may point to different valencies within a specific faculty – some faculty units may have a more developed academic core while others (such as Nursing) may have a less well-developed academic core, and struggle to conceptualise connections to the core in the design and execution of their university–community engagement projects.

The findings confirm the relevance of discipline as a determining factor of interconnectedness. However, they also show that disciplines that are frequently cited as being at a disadvantage when it comes to making connections to external communities, such as the Faculty of Arts at NMMU and the College of Humanities and Social Sciences at Makerere University, are able to interconnect. This may point to the relevant but lesser contribution of the disciplinary valency of an engagement project when compared to the ability of project leaders to connect between different networks regardless of their disciplinary background.

### *Differentiating the core*

While it seems important to distinguish between projects charged with distinctive disciplinary properties, it is also possible to differentiate at the project-level between the two core functions of research and teaching that make up the academic core. In other words, some projects may link exclusively to either the knowledge transfer function or the knowledge production function.

While very few projects at either university scored well on the academic core indicators, it is possible that some projects chose to focus exclusively on research while others elect to focus exclusively on teaching and learning. An argument could be put forward that research (i.e. the production of new knowledge) is the only imperative for any university and that everything else, including teaching, follows. This stance challenges the inclusion of teaching and learning as an equally weighted contributor to the academic core. The knowledge creation imperative is not disputed; however, conceiving of the knowledge creation and transfer process as one that is unitary is contested. In a differentiated arrangement either

within or between institutions in a single national system, it is conceivable that specialisation occurs, with different actors playing different roles at various stages in the knowledge creation and transfer process. Knowledge creation remains a critical and non-negotiable first step in this process, but it seems possible to conceive of a process in which certain academics specialise in knowledge creation while others specialise in knowledge transfer (including teaching and even application). That those with specialist roles in the knowledge creation and transfer process are linked together across or within universities in a differentiated system is essential in ensuring an uninterrupted flow in the process.

From an organisational perspective, faculties, departments, centres and institutes could take a differentiated approach to how their projects connect to the academic core. If this differentiated approach is one that is coordinated and managed, then it could be that no single project scores well on the interconnectedness axis, but that a centre or faculty as a whole may well do so if it were to be taken as the unit of analysis. In other words, the sum of the parts should be taken into consideration before dismissing a coordinated cluster of projects as being disconnected from the academic core.

### *Switches*

The university–community engagement projects referred to thus far are the temporary structural arrangements around which activity is organised and coordinated. But it is academics who create projects and manage their activities.

The indicators of interconnectedness reveal variance in the university–community engagement activities at both universities. Some engagement activities returned a high score and can therefore be described as interconnected, while others returned a low score and can therefore be described as disconnected. Those projects that are interconnected are proxies for academic project leaders who are seemingly well-equipped or agile enough to connect both to the science community and to those communities located

externally to the university. In Castellan terms, these academic project leaders appear to be able to connect successfully between the space of flows and the space of places, acting as network switches. In a networked world, this allows academics to 'exercise control over others' owing to their 'ability to connect and ensure the cooperation of different networks by sharing common goals and combining resources' (Castells 2009: 45).

Castells makes it plain that network switches are not (or at least should not be considered as) individuals who are able to mobilise their own personal ambitions to reprogramme networks: '[switchers] are not persons, but they are made of persons. They are actors, made of networks of actors engaging in dynamic interfaces that are specifically operated in each process of connection' (Castells 2009: 47). Castells does not provide extensive coverage on the agency of individuals in global networks. This gap evokes similar criticism levelled at neo-institutional theorists who, it is claimed, do not account adequately for individual agency within social arrangements (see, for example, Greenwood & Suddaby 2006; Hardy & Maguire 2008; Swanson & Ramiller 1997, 2004). In the analysis presented here, individual academics are afforded agency in the global scientific network. But their agency as switches depends less on their individual or personal character traits and more on what they have to offer: knowledge. And knowledge due to its cumulative and communal origins does not definitively vest in a single individual. To be sure, names of notable scientists are attributed to the discovery of vaccines, genomes and social theories, but their discoveries and treatises are predicated on the work and incremental contributions of others. In this sense, it is the knowledge produced by science and embodied in particular scientists that makes possible their role as knowledge-network switches. What differentiates them is first and foremost the value of the knowledge they have to offer place-based networks (and potentially to other global networks for which knowledge holds currency) and to a lesser extent their ability to attract the attention of powerful nodes in other networks.

The stand-out example of a project led by a university academic switching between science and community networks is to be found at NMMU. The Ocean Turtle Task Force Project scored 7.625 on the interconnectedness axis, the highest of all the projects at the two universities. The project brings together representatives from national turtle focal points in the Comoros, France, Kenya, Madagascar, Mozambique, Seychelles, South Africa and the UK. Representatives evaluate sites of potential international importance for the conservation, protection and management of sea turtles. The project aims to identify sites of particular ecological, socio-economic, cultural and educational value. Local conservationists meet annually for capacity-building exercises and for sharing data on the challenging topic of conserving migrating sea turtles.

The project aligned with NMMU's strategy and was one of the few projects bearing on NMMU's aspiration of being an African university. The project was initiated by the United Nations Environment Programme; the project proposal was multi-authored, and deviations to the proposal were permitted. The project had in place an advisory group that convened annually. The project had established links to government, NGOs, industry (regional fishing industry bodies) and to fishing communities. Funding came from three sources, all for two years, and with the option of being renewed.

The project has clearly made several place-based connections to articulate the meaning and relevance of its engagement activities. At the same time, the project connects to the non-material global network of science by offering the novel knowledge that has been produced by the project as the result of its localised connections. The project developed new interventions for the tuna fishing industry to protect the sea turtle population, and technology to record and track turtle migration. The findings of the project were presented at academic conferences and published in academic journals, as well as in the form of articles on the web and in the print media. The project led to the introduction of a new 15-week module on marine biology at the university. Postgraduate students

participated in the project as researchers and undergraduates were involved as project interns. The project was one of very few at either NMMU or Makerere University that included a network of international academics.

On the other ends of the spectrum are those projects that returned a low interconnectedness score, and that are disconnected, either from the science community or from those communities outside of the university. Which is not to say that these project leaders are not connected; rather they are exclusively connected to one network to the detriment of being connected to other networks.

Of interest at NMMU is how the engagement projects of two extension units in the Faculties of Science and in Engineering (Innovention and Entsa, respectively) compare with projects located in the parent faculties. In both cases, the engagement projects at Innovention and Entsa score lower on the interconnectedness dimension than do projects located in the faculties, although the Entsa projects still score relatively well compared to the broader population of engagement projects at NMMU. This would suggest that these extension units, set up to facilitate interaction between the university and external communities, were less successful in linking their activities to core functions housed in their parent faculties.

Describing 'new Third World universities' (Chapter 3: 50) and their place in the network society, Castells refers to specialised organisations that are part of the university system capable of organising external connections which, in conjunction with an emphasis on research, are needed to elevate a country's productive system (Chapter 3: 49–50). Castells is not specific about the role these specialised organisations are to play in the research process but he seems to suggest that in addition to faculty-based academics acting as switches between networks, certain structural arrangements could be put in place to act as switches between faculties and external communities.

The findings of the interconnectedness study show that the specialised organisations at NMMU responsible for 'extension' are focusing predominantly on organising external connections for the application of existing knowledge, either without consideration of

where the required new knowledge will come from as the demands of external actors evolve, or with the assurance that the required new knowledge will be produced by NMMU academics located in the faculty. Using bibliometric data on journal articles published as a proxy for the creation of knowledge, it would be possible to determine whether the parent faculties of these extension units are in fact deserving of the assurance placed in them by their extension units. What is not clear and requires further investigation, is whether, even if the extension units are successful at connecting to external communities and their faculties are independently generating new knowledge, there are effective bi-directional institutional connections between the extension units and their host faculties.

### *Valves*

While Castells recognises that in the space of flows, information possesses directionality (Castells 1989), he provides little by way of evidence on how directionality functions in globalised digitised networks, or how information flows between the dynamic intersection of the space of flows and the space of places.

The method proposed by Van Schalkwyk (2015) to operationalise interconnectedness does not claim to capture nor reflect the impact of engagement activities on those actors with whom academics engage. In this sense, the impact of their engagement activities is only measured in one direction; that is, on the university. It is conceivable that projects that score low in terms of the extent to which they strengthen the academic core may nevertheless have a meaningful and positive impact on a particular community or enterprise. However, such place-based impact does not necessarily add value to the university's position as a node in the globalised network of science. Van Schalkwyk's notion of interconnectedness therefore *assumes* a bi-directional flow, even if it did not operationalise impact in both directions due to its primary concern, that is, the impact of engagement on the university's core functions. This is a critical point often overlooked by the proponents of engagement. A singular focus on the flow of value from the university to a place-

based community, ignores the vital return flow of information that places the university in a better position to contribute to the flow of information and, by implication, the creation of the new knowledge needed for development, in globalised scientific networks.

The study of interconnectedness shows that at both NMMU and at Makerere University there appears to be an under-appreciation of the requirement for bi-directional flow of information (and value). Most projects display the properties of valves rather than switches in regulating the flow of information. At the same time, there does appear to be a growing recognition at the system level, in South Africa at least, of the pitfalls of valve-like engagement. The South African Department for Higher Education and Training's *White Paper for Post-School Education and Training* (Department of Higher Education and Training 2013) states that 'it is likely that future funding of such [engagement] initiatives in universities will be restricted to programmes linked directly to the academic programme of universities, and form part of the teaching and research function of these institutions'. It remains to be seen whether such sentiments are leveraged or incentivised in order to render them effective.

### *Conclusion*

Like The Copula Hall that connects the doppelgänger cities of Beszel and Ul Qoma, the university and its academics must connect between different social realities, that of science and that of the communities that lie outside of the university. And it must do so to fulfil its dual mandate of knowledge production and relevance. However, unlike The Copula Hall that makes possible sanctioned connections between two co-located physical spaces, universities must connect between two different types of networks, one that Castells describes as being defined in terms of place and one that is defined in terms of (information) flows.

The overarching objective of this chapter was to make a modest contribution to Castells's 'theory' of the network society by exploring the possibility of different types of connectedness

in university networks. It did so by examining the connections university academics make as part of their community engagement activities, proposing that a particular type of connectedness is in operation at universities, and showing that disciplinary valency and the directionality of connections matter.

Situating university–community engagement within Castells’s network society allows for the interpretation of engagement as the (inter)connectedness of university academics and their host universities within and between networks. Universities seeking to engage with external communities must navigate between two distinct networks in tension – one which is global, programmed by the logic of science and propelled by the flow of information across a space of flows – and one that is local – programmed by the logic of innovation in a space of places. The capacity of universities and their systems to manage this tension and the dexterity of academics and the value of the knowledge they have at their disposal to connect between networks is crucial for development as it connects new knowledge to entrepreneurs (of both the social and economic kind) and to inventors who spur innovation.

The indicators of connectedness reveal a mixed picture at two African universities (Van Schalkwyk 2015): in both cases, there are engagement activities that can be described as interconnected and there are also activities that are clearly disconnected. ‘Articulation’ scores at both universities were stronger than the ‘strengthening the academic core’ scores. In other words, the degree to which university–community engagement activities can be said to be strengthening the African university as a key knowledge-producing institution is uneven and too frequently marginal.

The study of two African universities also shows that there are projects located in university structures (organisational sub-units) that are adept at connecting the university to external communities. However, these structures are not simultaneously connecting to the core university enterprise of knowledge production (research) and transmission (teaching). This is not to say that faculties at these universities are not productive or that they are absent from the global networks of science. In fact, if we use publications as a proxy

for scientific productivity, then both universities show a marked improvement since 2000 (Bunting et al. 2014). It is therefore still possible, as suggested by Castells, for bridging agents or intermediaries to facilitate bi-directional flows between faculty and outreach organisations. Further research is required to establish the existence and effectiveness of such structural arrangements.

What is clear from the study is that some academics at the two African universities are able to connect across networks, acting as switches in the flow of information between and across different networks. These networked academics make possible the bi-directional flow of information, in so doing connecting the university to external communities in a manner that at the very least creates value for the university as a node in the global scientific network. This illustrates not only the importance of the direction of flows of information for development (often under-appreciated by advocates of university–community engagement), but also the possibility of African universities strengthening their hand when negotiating their participation in global science networks while remaining relevant to local development needs.