

# **Deep Impact: Re -conceptualising University Research Impact using Human Cultural Accumulation Theory**

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## **Abstract**

Measuring impact from university research is increasingly seen as important, not least because of its use in resource allocation processes by governments. These measurement approaches, however, often take 'wide and shallow' economic effect-based views that are ex-post, linear and uni-directional. Consequently, research collaborations between universities and external stakeholders are often ignored, particularly when stakeholders are local or community-based and the research focus is on social rather than purely economic ends, because impacts of these projects are less easily measured, and are more likely to have narrower (though deeper) effects spatially. Using an illustrative case study, this paper shows that there are mechanisms able to measure broader concepts of impact, specifically ones where impacts also occur through the PROCESS of undertaking the research itself (as opposed to just as a RESULT of it), highlighting ways in which this type of analysis could be utilised for future evaluation of research collaborations.

**Key words:** Impact; collaboration; university research; social network analysis; university-community

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## **Introduction**

Universities are increasingly under pressure to demonstrate the relevance of their research outcomes and outputs to the wider economy (e.g. see Australian Government Productivity Commission, 2007; Chubb and Watermeyer, 2017; O'Flynn and Barnett, 2016, 2017). Indeed, the UK Government has used both legislation and finance through the Higher Education Innovation Fund (HEIF) to promote increase collaboration between universities and local businesses (HEIF 2012), something also encouraged via EU-funding to increase research synergies in general (Caloghirou, Tsakanikas, and Vonortas 2001). Despite recent efforts by governments to evaluate societal impact from 'take-up' of university research by the non-university community, there is continuing reliance on 'traditional' and often problematic (e.g. see Marcella, Lockerbie, and Cameron 2015; Watermeyer 2016) impact measurements, identified through post-research publications (and citations for the academic impact), and policy changes, at wide spatial levels, with little measurement of behavioural impacts and collaborative influence generated through processes of conducting the research itself. Additionally, there is often a focus on economic rather than societal effects when measuring these impacts (e.g., Jones et al. 2017; Mullins 2015).

Current impact frameworks, therefore do not go "deep enough" into the relationship aspect of research that underpins overall impact, largely because they do not look at distinctly human relationships or at the accumulated impact of those relationships on human culture. Traditional measurement approaches also have the effect of painting universities' roles within regional and national ecosystems as relatively peripheral. To provide societal context, whilst also measuring deeper impacts that may be possible with university-non-university stakeholder-based research collaborations, this article re-conceptualises research impact as

achieved via processes of cultural change described from within cultural accumulation theory, to identify impacts of projects that are less easily measured and are more likely to identify narrower (though deeper) effects spatially than traditional measurement approaches.

A case study of a dynamic research project, undertaken in a university-community collaborative practice context, is presented to illustrate how this view of can accommodate a range of research impacts in terms of deeper societal influence at local levels. Implications are discussed for governance and policy formation based on measurement of this re-conceptualisation of impact, which operates through human social interaction in short and long time frames.

### **Traditional Categories of Research Impact and Recent Frameworks**

Many governments are currently examining the potential of national university research impact assessment strategies. In the UK, the Research Excellence Framework (REF 2014) introduced a research impact element (see Watermeyer 2014), measured through case studies identifying benefit of research to the wider economy, society, culture, public policy or services, health, environment or quality of life, giving this a 25% weighting in the latest REF. This broad view of impact is sometimes elaborated in terms of the so-called third mission, where policy makers in many countries have encouraged universities to generate, use, apply and exploit university capabilities outside the academic environment (see e.g., Molas-Gallart et al. 2002; Rosli and Rossi 2016). As part of the National Innovation and Science Agenda (<http://www.arc.gov.au/engagement-and-impact-assessment>), the Australian Research Council has also developed a pilot 'Excellence in Innovation for Australia framework' to be used alongside conventional academic measures of impact (see discussion in Marcella et al. 2015).

Niederman et al. (2013), however, identify a range of difficulties inherent in finding ways to effectively and accurately measure or evaluate the impact of research collaborations, related to the diversity of the academic community in research topics, methods, and philosophies, and consequent lack of consensus on ways to define, measure, and increase positive impacts of research. As the following scholars demonstrate, there is currently no universal consensus on what research impact means, despite it being a widely adopted term (Brewer 2011). Nutley (2003) identifies the conceptual impact of research as equivalent to changes in levels of understanding, knowledge and attitude, instrumental impact being equivalent to resulting changes in practice and policy making. The London School of Economics (LSE) Public Policy Group, in their social impact of social sciences project, define research impact as ‘an occasion of influence and hence it is not the same thing as a change in outputs or activities as a result of that influence, still less a change in social outcomes’ (LSE 2011, 21).

Elements of diversity have been embraced within some recent impact frameworks. The REF, for example, measures the overall quality of submissions for impact in three categories: (a) quality of research outputs; (b) impact of research on society; and (c) research environment. This view is also supported by increasing demands by governments and other funding bodies for clear evidence of returns on research investment in terms of impact on society, for example through enhanced service models and more powerful medicines (e.g., Marcella et al. 2015; Mullins 2015). Nevertheless, in the current environment of escalating fiscal constraint, demands to demonstrate impact centre on perceived economic impacts, even where social effect may be an overarching concern (e.g., O’Flynn and Barnett 2016, 2017).

The rationale for research impact frameworks, at least in OECD countries, also appears to be centred, narrowly, on allocating finance (see discussion in Jones et al. 2017). This can be seen, for example, in moves by some government bodies to include, as a condition of

funding, provision that research has a proven effect outside the university environment. In this sense, the REF system could be considered as using a broad impact framework applied in a narrow, selective way, to determine the effect of university research on bodies and policy external to the university, assessed in terms of wide constructs as ‘reach’ and ‘significance’, but primarily aligned with allocating research funding. Impact under this definition is evidenced by traditional bibliometrics (such as journal impact factor and H-index, generally quantitative) and, increasingly, altmetrics (analysis of article referencing in social media, such as twitter, both quantitative and qualitative), but also by take-up of research in subsequent policy statements and products from the non-university community, for example, industry and government, utilising linear evidence trails to identify how impact occurred.

### **Considering the Impact of Research Collaborations more Broadly and Developing the Proposed Framework**

University research collaborations have broad relevance as contributors to society (e.g., Ozanne et al. 2017). Research collaborations specifically, both within and across sectors, are also long recognized as important conduits to the innovations required for the enhanced productivity necessary for continued economic growth as well as to adequately respond to current and future societal challenges (Alutto 2008; Levin, Qi, and Edelstein 2013). Despite its popularity, the term ‘research collaboration’ remains a notoriously ‘fuzzy’ concept (Huang 2014; Katz and Martin 1997). This paper follows Griffin, Hamberg and Lundgren (2013), in conceiving research collaboration as not just joint work between researchers in achieving research objectives, but rather involving the full array of persons engaged in the project, including project members. Collaboration in this sense ‘presupposes that a shared research goal is defined by activities rather than by the actors involved, and the term is reserved for research that includes personal interactions’ (Kwiek 2018, 141). It is argued here that research collaborations, in fact, require social or collaborative interactions (relationships),

some of which may be person-to-person and some of which may involve more than two people as group interactions (see discussion in Tomasello 2014). Such collaborations, in the context of this article, also include interactions of people with stored information (for example, via reading) that creates new meaning, actions, or outcomes, as will be outlined in the following section.

Having a clear, broad, and deep, conceptualisation of the impact of such research interactions is therefore increasingly important for universities and the funded research with non-university collaborators that they are increasingly encouraged to support (e.g., in Australia via CRCs, in the UK via EU funding). What is needed, however, is examination of what impact actually means across the various research contexts of university-non-university stakeholder research collaborations, and how an impact framework could accommodate the various current conceptualisations of research impact (see e.g., Brewer 2011; Martin 2012). Any such framework should include an impact assessment that is neutral, in the sense of being able to identify (unintended) negative effects as well as positive benefits.

To overcome the limitations of current impact practices, and their fragmented and often single-focus approaches, this article argues that research impact should be re-conceptualised from within a context of cultural learning, a feature of the interactions of people with their environment (including that which arises from interactions between university and community), with impact arising through the process of the cultural change engendered by the research itself. In this re-conceptualisation, cultural learning is the basis for the collective accumulation of knowledge, skills and experiences (culture *sensu* Tomasello 1999) across society, a process referred to as cultural accumulation (Tomasello 1999, 2016; Woolcott 2016). This view of culture aligns with Ginzberg (2017, 19) in his review of definitions of culture as: ‘understanding of culture as an all-encompassing human phenomenon, and a more

effective means for selecting the appropriate methodologies needed for the analysis of relevant questions.’

In this broad sense, overall impact emanates from cultural change in a context of the cultural learning of members of a research collaboration. A component of the impact of that research collaboration, due to cultural change, may contribute to societal cultural accumulation as residual or ‘left over’ in the system (e.g., see Powell et al., 2016). Cultural learning therefore relates to the overall context, whilst cultural change is the part of cultural learning that embraces overall impact or influence, with any resulting residual impact comprising observable evidence of that cultural change. This residual impact can further influence other people, for example, as personal memory, agreed ways of working, a book or computer file, or citation. The term residual cultural accumulation, therefore, can be used to refer to the portion of societal cultural accumulation resulting from the cultural change within the research collaboration.

Considering this broad sense of impact has enabled the construction of a proposal framework within which to better interpret and understand the creation and measurement of the value of collaborative research interactions as a next practice measurement architecture based in residual impact. Using this conceptualisation of residual impact identifies societal effect as a type of residual cultural accumulation, better capturing the intention of various frameworks for collaborative research impact being established in many countries. For example, while Mullins (2015), Martin (2011) and Watermeyer (2016) have argued the pros and cons of the REF, it remains challenged by the lack of an underpinning foundation embracing the capacity of individuals or groups to impact or influence one another through a person-to-person relationship embedded within the research collaboration itself.

Consequently, REF also remains challenged by not adequately measuring the effect that such relationships may have on society collectively—that is, the view that individuals and

their multiple interactions can have important and far-reaching change effects at multiple levels in sometimes complex environments (Keast and Mandell 2013; Scott et al. 2018).

There have been several publications considering the impact of collaborative interaction based on relationship connections (e.g., see recent discussion in Bertsimas et al. 2014; Li, Liao, and Yen 2013). These studies have, however, been focused on academic impact, rather than narrower or deeper effects spatially. The impact described in Bertsimas et al. (2014), for example, tracks back through researcher co-authorship and citation data, such as numbers of publications or grants, to predict whether a researcher has impact in terms of academic advancement within higher education. These studies are also limited in often not including qualitative analysis related to personal interaction that might also inform the network analytics utilised, especially for value-adding outcomes (Keast and Mandell 2013). Such impact measures are, however, based on widely used social network analytics (SNA), which interprets patterns of relationships and in principal there is no reason why such an approach could not be adopted, particularly given the need for a wider evaluation of research impacts than is currently taking place.

Human social structures and their influences are related to cultural accumulation, which arises from cultural learning as the distinctive and collective human synergies of person-to-person social interaction and interaction of individual persons with the environment, including other persons (Tomasello 2016; Woolcott 2016). Within a research collaboration, cultural change, engendered by such relationship interactions in the cultural learning context of the collaboration, gives rise to residual impact. This brings two important considerations into the discussion: expansion of the range of traditional impact measures; and a focus on research impact as ‘our’ rather than ‘my’ impact, examining relationship formation and its influence underlying deeper impact measurement.

In this framework, impact is re-conceptualised to consider diverse research collaborations and contexts in addition to economic or policy domains (Brewer 2011)—human capital is set within the influence of social interactions, as well as social, economic and cultural capital (e.g., see Augusto Felício, Couto, and Caiado 2014). The re-conceptualisation therefore captures impact in terms of the cultural effects of societal interaction, rather than a particular type of capital or particular impact or influence category. This has relevance to consideration of impact in several differing spheres not exclusive of environmental, economic or social change, but also inclusive of governance and policy, as well as in the increased use of modern forms of social communication, such as email and twitter.

Cultural change can then be viewed as the influence of one individual, via social interaction, on memories stored by another individual through single or group interaction and interactions with externally stored culture (this view embraces traditional or authentic views of collaboration such as described in Innes and Booher (2010)). Cultural change in this sense can be seen in terms of an impact mechanism (way of influencing) and/or a result of human interactions (influence). Such cultural change instantiates through accumulation of internally stored culture as memories obtained through imitation, instruction or collaboration, including with shared intentionality (Tomasello 2016), through accumulation of externally stored culture, such as books or electronic media (Woolcott 2016), or through feedback interactions of people with culture so accumulated.

Figure 1 shows the proposed framework, illustrating how person-person interactions as well as person-environment interactions contribute, within a cultural learning context, to memory accumulation within individuals and across the group of people interacting in the collaboration. Persons in the collaboration also interact with stored knowledge, skills and experiences, the accumulated culture available through such storage devices as books and computers. These back-and-forth interactions result in cultural change through the process of

the research collaboration, contributing to outputs and outcomes that form the residual impact of the research collaboration. It is useful in this framework to then consider outputs as tangible impacts and outcomes as intangible, largely behavioural impacts (Keast et al. 2004). Residual cultural accumulation can then be considered as the contribution, through residual impact, to collective accumulation of knowledge, skills and experiences (i.e., culture), in contexts of cultural learning (shown in Figure 1), that has both tangible and intangible aspects.

(Figure 1 about here )

Based on this description, residual impact and residual cultural accumulation in research collaborations can result from collective and on-going interaction through efforts of an individual researcher. Several authors, for example, have made a connection between identification of an issue and individual action (agency) within a collaborative network (e.g., Raab and Kenis 2009), individuals influencing network member actions to change existing, often imposed, collaborative focus, structures and processes to better fit purpose (Podolny and Page 1998). The role of identity and individual and collective agency (shared intentionality) in achieving successful collaborative interactions, however, is often ignored, as is the nature of the relationship between identity and agency (Keast and Mandell 2013).

Positioning residual impact as emanating from cultural change within a context of cultural learning identifies potential impacts of university-non-university collaborative research and how it contributes to change in societal and community culture through the process of change in, and accumulation of, collective culture across society—deeper impact in a very real sense, including instruction, teaching, team work, or other personal or group endeavours. Residual impact is situated, therefore, within an environment that includes diversity of end users, including those that have adapted findings of research to policy due to direct involvement in the research program, but also via collaborative interactions such as multimedia exposition or

community events, or personal agency and shared intentionality in collaborative interactions significant for impact measurement. Residual impact, from this cultural change perspective, therefore includes influence or ‘occasion of influence’ (LSE 2011) that leads to a process of residual cultural accumulation, underpinned by a foundation that enables a view of impact in society obtained in a cultural learning context, directing attention to outputs and outcomes that may develop as a flow-on from relationships, confirmed by third-person observations.

### **Study Approach and Methodology**

To illustrate, this approach is applied to a university-local community research praxis case—research and practice involving interactions of multiple stakeholders in a variety of cultural learning experiences. The case study research project investigated the efficacy of community services provided in a regional (i.e., non-urban) area of Australia as part of a large-scale Services Integration Project (SIP) conducted as a collaborative partnership of twenty service agencies with a university researcher, and facilitated by a university. The SIP itself was formed as a response to widespread community anger at the perceived failure of government departments to address ongoing social and economic problems, despite significant investment of funds. Contrary to the short-term evaluation horizons of many service integration research studies, this project drew on and extended an existing study to generate a longitudinal data set to better inform the achievement of effective and sustained integration.

The SIP was purposefully selected as an information-rich case study illustrating collaborative research practice. The deliberate use of the SIP offered the advantage of its being previously assessed as an exemplar of collaboration through a network structure, that is, it meets established collaborative network criteria where many other ‘collaborations’ do not (see e.g., Head 1999; Keast et al. 2004; Muirhead and Woolcock 2008). Secondary data

originally designed and collected for SIP case was also purposefully used as it provided a small number of samples that were also information-rich, as well as available and sufficiently detailed to generate insights on this subject from project members (see discussion of similar sampling in Palinkas et al. 2015; Patton 2002). This purposeful selection allowed an examination of how the SIP, as a collaborative research network, enabled cultural learning interactions across individuals in a group of government and community agencies, aided by external facilitators and researcher within a university development program. The project included collective and community learning experiences, as well as learning experiences of university researchers interacting with that community.

In some ways the SIP was not a typical university-non-university research collaboration; while the project involved a conventional exchange of research for funding (Edmondson et al. 2012; Van de Ven et al. 2008), it departed from convention in its longevity in various forms after funding and because the universities involved did not receive funds (one university was a co-founder and facilitator of the process. Also, one of the authors was the ‘researcher’ (lead university researcher), who was not directly involved in the design or implementation of the SIP, instead having a ‘hands off’ role as ‘observer/researcher’—the SIP used the findings and data collected from observation and research to inform and shape their practices. In addition, the explicit focus of the SIP was on a partnership agreement that involved shared insights and utilisation of university research for community use, as well as agreement to reconceptualise and reconfigure community communication and cultural distribution networks and operations to gain value (Muirhead and Woolcock 2008).

The value of the case study here, however, is that it provides an exemplar illustration of the range of residual impact that CAN be evidenced within a university-non-university collaborative research context, given the use of relevant assessment tools (namely SNA and interviews) DURING the process of undertaking the research itself. The selected case study

allows examination of residual impact in a context where mediated praxis (Gutiérrez and Vossoughi 2010) was enacted through university researchers exchanging information in a dynamic way with each other and with their non-university research associates, as well as with study participants. The following research questions reflect the focus on the dynamic nature and broad stakeholder connection of the selected case study.

1. *How can analysis of university-non-university collaborative research networks inform the discussion of residual impact and resultant residual cultural accumulation within a broad context of cultural learning?*
2. *How can an examination of cultural change and residual impact contribute to and enrich discussion of collaborative research impact measurement?*

To answer these questions, the SIP case study is examined to see how residual cultural accumulation ultimately results from human relationships that dip into and interact with the collective well of accumulated culture. The case study additionally examines how residual impact can be measured from research and practice collaborations of multiple stakeholders across a community, undertaken as part of a university-non-university collaborative research project. This retrospective examination includes analysis of qualitative data generated from a variety of sources, including meeting notes and minutes, personal journals, and recorded semi-structured interviews and focus group meetings, with a focus on reflective interactions, feed forward and feedback, both inside and outside the university context.

Specifically, thematic and SNA analysis was used as a proven place-based case study approach to determine the level of interaction from, and subsequently integration, within and between service systems (see e.g., Keast, Brown, and Guneskra 2009). The thematic analysis of key informant and stakeholder narrative as a part of the case study was

complemented by the quantitative power of SNA, conducted using open source network software, predominantly UCINET (Borgatti 2012), and its ability to visually represent levels of integration present in multiple layers of exchange and interaction. This combination analysis also allowed closer more nuanced examination of significant collaborators and events, including examination of personal and differing perspectives (see e.g., Muirhead and Woolcock 2008). All qualitative material was transcribed and examined manually to identify emergent themes coded for the Nudist qualitative data analysis system (Richards and Richards 1991) or NVivo and examined against the integration framework created (Keast 2004). Quantitative analysis included use of statistical analysis software (SAS/STAT) to provide basic descriptives, such as frequency, tabulated for within and across case data. SNA included SAS Enterprise MinerLink analysis using intensity and density of connections. A summary of data collection and analysis methods, including informant information and data collection foci is given in Table 1

<<Table 1 about here>>

### **Case Study: Goodna Services Integration Project (SIP)**

Goodna is a small peri-urban community located between two urban cities, Brisbane and Ipswich, in south-east Queensland (Australia). Goodna is populated by a wide range of disadvantaged groups, with multiple problems related to long-term socio-economic disadvantage. Accordingly, the district had been subject to considerable on-going intervention by both government and local service providers, and therefore the recipient of substantial amounts of government funds. Despite this, problems in this area remained

entrenched, often seen as unintended consequences of fragmented interventions and funding, as the following confession indicates:

‘Any problem in Goodna we [government] created. We put the public housing there; we put the prisons across the road; we put the mental health hospitals down the road... It is this sort of activity that has created the issues that are here in Goodna’. (Interview Respondent)

While there were numerous problems confronting this community, a major offence, perpetrated by several clients with whom many of the departments and local services had responsibility, galvanised the agencies to come together in a series of informal meetings to reflect on what had occurred, and the perceived failure of multiple services.

‘People were saying this is terrible – it was the fault of the failure of a whole lot of systems... The whole thing spilt out and over into the community who were expressing real concerns about the failure of the services involved and the safety of the community’ (Interview Respondent)

In response to the crisis, discussions were initiated between the regional government managers involved in human services, formally auspiced the Regional Managers’ Forum, to improve service delivery and address serious social issues. Their connecting activities were provided by a local university engagement outreach project, the Community Service and Research Centre (CSRC later renamed the UQ Boilerhouse) which acted as advisor and facilitator, providing research, teaching and learning expertise as well as evaluation skills. Funding was provided (eventually) via three state government departments. The university of Queensland (UQ), through the CSRC and Ipswich City Council, also provided substantial in-kind support to the project.

A change climate was created through the CSRC that enabled the establishment of a trial

collaborative project aimed at improving government service delivery through linking agencies, informed by new cross-sectoral integration methods and research grounded in place-based rather than programmatic criteria (Muirhead and Woolcock 2008). While the SIP was created as a response to the unique and complex issues faced by Goodna as a community, it also acted to chart new ways for government to do business. There was also desire to have front-line staff participating in the project, extending the reach and impact of the learning and experience. The overall aim was to develop a sustainable system of human service provision by:

- aligning the needs of local citizens with government priorities;
- building social capital and community wellbeing, integrating human services; and,
- building relationships, promoting learning processes and giving emphasis to measuring and modelling inter-connected strategies to create systems change (Woolcock and Boorman 2003).

The SIP team looked to achieve a sustainable system of human service provision based on a deliberative policy and practice of integration through the collaboration of different groups and levels. However, members realised that, in order to be genuinely different, they would need to build genuine relationships and listen and learn from each other (Keast et al. 2004, 16). The vision for the SIP was ‘working better together for sustainable community wellbeing in Goodna’ (Muirhead and Woolcock 2008, 12).

‘At the very beginning it must have been a struggle... there was no trust and no relationships ... there was no testing of assumptions – just an acceptance that the problem was caused by others’. (Interview Respondent)

Whilst the integration literature and associated methodologies were highly relevant in formative and subsequent phases, and the SIP membership team was aware of the importance of repairing relationships between regional government and the Goodna community, there

did not initially appear to be a research methodology that could readily inform the relationships building process. Involvement of the researcher, however, identified a key domain of new literature that became very relevant to the SIP, that of network theory and application of SNA. As Muirhead and Woollock (2008) later reflected, the SIP members learnt much from the researcher's analysis and that of other scholars in this area, specifically concerning community-centric relations, embracing a range of inter-organisational relationships and structures at different types of utilisation and at various levels of networking and, therefore, differential relationship strengths.

### *Development of the SIP*

In the initial project stages, there was a set pattern of behaviour, driven from government through particular types of service delivery from different levels of bureaucracy, with high activity in some areas and low activity in others.

‘Things were done to the community. Poured on them from the top’. (Respondent interview)

There was no great degree of feedback or feed forward from the community requiring the service being provided, nor any attempt to evaluate the service delivery from multiple stakeholder perspectives. Thematic analysis supported the embedded relationships indicated by an initial SNA across a number of relationship networks, as well as fractured relationships within the community resulting in a negative residual pattern of interaction—blaming and finger pointing—eventually seen as the basis for the community crisis that promoted the SIP. The initial combined analysis also showed, however, that participating agencies shared collective responsibility for service provision.

‘I think that it has given the issue of integration—collaboration etc—visibility; it is getting more people talking about it. So, if there was any benefit it is probably ...moving towards a preparedness to look at change’ (Interview Respondent)

Because of this initial assessment, demands were made that a more integrated approach to service planning and delivery be developed in which agencies moved outside their individual ‘silos’ to form collaborative networked responses to address shared problems (Woolcock and Boorman 2003). To do this, service providers recognized they needed to fundamentally change the way they worked together, resulting in the twenty agencies, often previously antagonistic or competitive, beginning to work together constructively, with the support of specialist facilitators, a university program and input from the external, embedded university researcher. Crucially, community members were subsequently engaged as active stakeholders via training events, providing residual basis.

Later qualitative analysis (outlined in Table 1) showed the degree to which residual impact was altered as cultural change was enacted through improved collaborative and reflective practices across the developing project. The residual impact of the post-initial project stages can be seen in the reported development of a more comprehensive flow of communication across the SIP members and the resulting consolidation and formalisation of the SIP structures and processes as well as awareness across the university and SIP community of ongoing social benefit. The following comment summarises the view only a short time after the consensus decision to change to a more integrated collaboration:

‘Talking about practical outcomes we have created a process that allows for, and continues to encourage, that process. We are talking about the residual capacity of this network, that is what remains after this intervention has been completed. People can go back to this network and the relationships to build or work on other projects and can use those resources as a way of mobilisation’. (Interview Respondent)

### ***Teaching and Learning within the SIP***

A number of significant teaching and learning provisions were facilitated within the SIP, including dedicated programs, Community and Interprofessional Leadership short courses, community-based learning events and action learning projects (Muirhead and Woolcock 2008). Such teaching and learning events may not be used in traditional impact frameworks and, in terms of the proposed framework, these events would be ways of utilising residual cultural accumulation in back and forth interactions driving further cultural change.

An example of residual impact emanating from such interactions can be seen in the formal dedicated learning program implemented with a Graduate Certificate in Social Science (Interprofessional Leadership). The Graduate Certificate, the first accredited learning programme initiated through SIP, was run over two semesters and exposed students to fundamental principles of collaborative practice. The students learnt theoretical groundwork and practical skills for initiating and sustaining collaborative work, supported and guided by university teaching staff, practicing professionals and community representatives. The first cohort were all senior staff from government organisations based in the region, second and subsequent cohorts including front line staff from government and community organisations as well as community members.

One of the most significant changes was seen in how implementation of the Certificate generated interest-based negotiation and collaborative dialogues, used to purposefully facilitate in participants a deeper understanding and appreciation of each other, as well as of each person's organizational strengths and limitations. This course required participants to dedicate two days a month for six months learning to work together, smoothing over issues, learning a common language and developing a common vision. It was widely argued that this training program, conducted as part of the research project, provided the foundation for the

success of this project in delivering cultural change through the way members worked together and ultimately innovations to the service delivery regime:

‘I put that down to the learning program we did together. Because we learnt about each other in a way that could not have been possible if we had just been going to meetings once a month for a couple of hours and having a coffee. We were able to step beyond our own needs and hang-ups to see the big picture’. (Interview Respondent)

Via the ongoing study of the SIP case, post project (third round of) data collected via questionnaire and key interviews, and as reported in Keast, Brown and Guniskarra (2009), evidence of improved communication was identified. Specifically, by developing a common language members were able to build collective commitment to joint action through shared intentionality. Further, it was contended such intense interpersonal experience, focused on learning and language, cut short the usual lengthy relationship building process, enabling the network to move more quickly into genuine collaborative interaction, learning a new way to communicate and developing a new shared language. In other words cultural change resulted in project participants gaining long-lasting ability to deal with each other more effectively on future issues, constituting a residual impact from university-non-university research collaboration.

### ***Limitations of the SIP case study***

Clearly there will be limitations for this type of research, these falling into two, overlapping, components: limitations imposed by the specific case study used itself; the limitations of the analytical framework if it was applied more generally. Following Fenno (1990) and Rhodes (2001), and in order to reduce the potential for capture or over rapport—and loss of objectivity—meticulous recording of case notes, full transcripts of all interviews and focus

groups and the use of a research diary and research reference group were used to encourage reflection and self-criticism. Nevertheless, the researcher as close observer has the potential for capture and/or normative bias, especially as the researcher had prior working relationships with some SIP members and was known to have worked previously in the sector. Prior experience within the sector as both public servant and community practitioner, whilst it likely afforded greater 'entry' to the cases and higher levels of respondent disclosure, also brought the potential for 'respondent' capture—not remaining neutral and influencing the comments.

In terms of limitations imposed by SIP itself being a bounded case, peripheral groups (other than the key informants) who might have additional insights or comments might be omitted and this was partially overcome by presenting findings to the wider community, and via a Peer Review Group, with subsequent written feedback and agreeing findings that resonated with their experience and perspectives (Muirhead and Woolcock 2008). A further potential limitation to the wider applicability of the case relates to the fluid nature of the sector itself (Lang 2002; Marston et al 2000) affected by considerable personnel and organisational change. Whilst SIP was largely exempt from this flux (Woolcock and Boorman 2003), it still might have affected the way SIP operated and the analysis.

In terms of limitations to the analytical methods employed, SNA at this time was just emerging, with computational power and visual outputs limited, compared to more recent advances. This was ameliorated at the time by (a) establishment of an external advisory group to monitor for bias and also the use of a research diary for self-reflection—which was provided to the external advisory body at each meeting. Also, findings were reported to SIP members (on various committees) for cross check and correction. Finally, because the current paper applied a secondary data approach drawing extensively from SIP data collected with another alternative focus (i.e., services integration) the questions asked were not specifically

purpose built to address 'impact'. Conversely one of the authors was directly involved in the design and implementation of the original study, noted by secondary researchers as an important quality element (Muirhead and Woolcock 2008).

It remains open, however, whether the chosen case itself represents a biased sample. Since the case is situated within a university-non-university collaborative practice context, it may seem unsurprising that the case study produces findings concerning collaboration and networking. Conversely not all research collaborations between universities are 'true examples of collaboration', SIP being selected because it has been identified as an exemplar of research collaboration (Huang 2014; Kwiek 2018; Woolcock and Murihead 2008).

## **Discussion**

Within the framework presented Cultural Change = Impact, that is, the overall impact or influence, whilst Residual Impact = Evidence for cultural change, essentially the observable "left overs" from cultural change, including interview data, since it becomes left over even though it provides insights on the cultural change interactions as people remember them. The case study outlined here illustrates a novel emphasis on examining residual impact of research collaborations through cultural changes envisioned and enacted via personal interactions within a cultural learning context. Viewing the CSRC and the SIP case study in terms of the proposed framework suggests that there are mechanisms able to measure broader concepts of impact, under the banner term residual impact, that occur through the PROCESS of undertaking the research itself as opposed to just as a RESULT of it. Applying the framework DURING the process of the research collaboration itself may allow collaborations to dig deeper into the myriad interactions that comprise university-non-university research collaboration and better determine any social effect within culture accumulated.

In terms of traditional impact measures, the CSRC generated more than \$5 million in localised research and teaching and learning projects. It was instrumental in generating 50 reports and publications, several participants invited to participate in national government expert committees and international forums, providing policy advice. The CSRC also hosted international scholars and exposed students to community-based learning experiences and community members to community-based learnings (with over 150 learning partnerships for student placements). Traditional impact measures are not available for the SIP specifically but, as Muirhead and Woolcock point out (2008, 10), the SIP was central to CSRC impact.

The use of traditional impact measures, however, does not appear able to take in the complete residual impact of either the CSRC or the SIP as noted by Keast et al. (2004, 26, reiterated by Muirhead and Woolcock 2008). Although SIP clearly changed the way government and government funded agencies did business in the Goodna community, there were few of the definitive ~~outcome~~ outcome-impact measures commonly utilised by government agencies that can conclusively demonstrate these changes. An example of non-traditional impact can be seen in the following comment regarding cultural learning from a respondent interview:

‘The level of learning has increased across agencies, because there is now a territorial, horizontal slice. That is, local and upward and downward. The second cohort of Graduate Certificate is a most interesting group as it is comprised of next level public servants and residents, along with senior managers who have joined SIP’. (Interview Respondent)

The case study illustrates how measurement of residual impact is achievable through a basis in examination, in this case via a combination analysis that included SNA, of the cultural artefacts that are produced through collaborative interactions inclusive of conventional outputs and outcomes such as publications and grants or behavioural changes.

Table 2 summarises measurements (the data methods and analysis outlined in Table 1) and how they could be used to document residual impact, based on records of interaction in the SIP, if a continual measurement process is applied to measure residual impact in a particular cultural learning context. This summary indicates that data can be collected to show how cultural change across a research project can contribute to residual impact at multiple levels and differing time frames, providing a measure of residual cultural accumulation DEEPER than that provided in current frameworks and outcomes, including any knock-on effects.

<<Table 2 about here>>

The case supports consideration of a dynamic view of measuring impact in terms of system processes, and change and innovation (Patton, 2010). The dynamic interaction portrayed in this case study may, in fact, be more typical of social interaction and change processes on which a full account of residual impact may rely. Close ties were apparent in collaborative interaction leading to cultural change producing residual impact, with new outputs and outcomes developed through new combinations of otherwise dissociated culture, a form of innovation fundamental to collaborative research (Steen and Macaulay 2012).

‘There was considerable discussion, to-ing and fro-ing, about our overall purpose and deliverables. I estimate that this took weeks to be finalized and the end product was quite different to the initial intentions. But because of this we managed to get a truly innovative vision and work program – much more expansive than the original’.

(Interview Respondent)

As Muirhead and Woolcock (2008) point out, coupling thematic analysis and SNA provides value in (a) understanding the literature and data and (b) using this to shape and

reshape the program and working models, including into the future, for example, showing sets of relationships embedded within the structure and operation of the services that remained localised within the area as a type of residual collaborative capacity and practice. Although they acknowledged the visible project achievements, SIP members realised the real gains related to the relational infrastructure or network capital established because of learning and working together—it was about more than service delivery itself:

‘...creation of processes in which the infrastructure and environment are created which allow for the innovations needed to deal with complex problems’ (Interview Respondent).

The following four sections illustrate how ways of measuring deep impact allow a full account of residual impact and resultant residual cultural accumulation within a broad context of cultural learning. These sections consider the research questions in outlining how analysis of research collaborations and the re-conceptualisation of residual impact can inform each other.

### ***An Understanding of the Function of the Current Collaborative Relationship Network***

The proposed framework suggests that analysis of university-non-university collaborative research networks, such as seen in in the SIP collaboration, can provide relationship and other information, not required in current impact frameworks, that informs the deeper view of overall impact on society of those networks. The framework argues for a view that interactions within a collaborative research network drive feedback and feed forward iterations of a cycle of cultural change, residual impact and residual cultural accumulation, all of which occur in the particular cultural learning context of the research collaboration.

Any measure of residual impact, therefore, must include a measure of how relationships established through interchange of internally stored culture are understood, as well as a

measure of the connections of people to externally stored culture. Combination analysis, such as undertaken in the SIP, can establish how a collaborative network functions for the social imperatives of a project, providing a basis from which to measure residual impact and residual cultural accumulation (see Tables 1 and 2). The combination analysis in the SIP case study indicated clear understanding of network function by at least some SIP members, for example, through use of reports of SNA measurements to prove this understanding to external parties.

In a more generalised cultural learning context, measurement of an understanding of a relationship network may be underpinned by thematic analysis, but any measurement of residual impact should also benefit from multidimensional analytics, such as SNA, including path-based measures (e.g., betweenness) and positional measures (e.g., centrality), dynamic network measures and time-ordered structures (Falzon and Resnyansky 2016). In this way collaborative research impact measurement can be built around the deeper conceptualisation of cultural learning and the drive toward social imperatives.

### ***An Awareness of How to Build Collaborative Relationship Networks***

Use of the framework suggests also that the discussion of collaborative research impact measurement would benefit from an awareness, within a university-non-university collaborative research network, of how to facilitate relationship networks that contribute to cultural change and residual impact. Awareness of relationship building can be examined, both directly and indirectly, by determining how project collaborators work together and specifically how they interact with internal and external stores of accumulated culture in a particular cultural learning context (see Table 2).

The case study illustrates a shared understanding of how to use structured sets of processes to facilitate such interactions, with evidence showing how prior relationships contributed to

outputs and outcomes from various SIP member combinations. Learning events, not used generally in traditional impact measures, signify the extent to which residual impact resulted from people interacting with internally and externally stored culture as a result of an awareness of relationship networks. From perspectives of residual impact of university research collaboration, the researcher was reported as instrumental as a value-added connector within the network through proactively influencing collaborative interactions, taking analyses, including the SNA maps, back to the project and working with SIP members to assist them interpret findings, as well as building capacity to self-evaluate and interpret. The net result was that all SIP members were able to then use feedback and feed forward interactions to rethink their networks (Muirhead and Woolcock 2008).

The measures derived from such interactions, for example, longitudinal mapping of relationship networks at regular intervals, are seldom recorded for use in impact evaluations, but the framework provides an overview of how such measures may be significant in recording how cultural change leads to residual impact through iterated processes.

### ***An Understanding of how Agency and Intentionality can be used to Leverage***

#### ***Collaborative Networks***

An important aspect of understanding the informed connection between university-non-university collaborative research networks and measurement of residual impact and residual cultural accumulation lies in understanding and measuring cultural change due to personal agency and shared intentionality. Such measures can be obtained through examination of leverage applied across case study networks to identify influential actors (nodes) and link collaborative development over time specifically to interactions of actors through their connections (Stovel and Shaw 2013). The case study examination suggests that a deliberate approach through individual agency or shared intentionality could be applied to more fully

utilise a relationship network for processes leading to social effect and measurement of residual impact.

In the case study, combination analysis provided evidence of participant network interactions that led to residual impact through a process of cultural change. For example, network interactions could be linked to increased reach and significance measured as increased quality and quantity of outputs from SIP members over time (e.g., publications and reports). These interactions could be linked also through documentation of behavioural change evident as outcomes, illustrating intentionality and agency directed at enabling people to work together in a goal-driven network. In the SIP, use of points of leverage was measured by determining the residual impact due to value-added connectors or network brokerage. Brokerage may be measured within SNA by documenting changes to a series of networks viewed over the duration of a project, where a person can be seen as bridging a gap from one triadic structure to another (Burt, Kilduff, and Tasselli 2013).

In the SIP, qualitative analysis indicated that the university researcher saw value-added connectors as an important consideration in network development, actively bringing people together in working parties rather than acting as a single bridging entity as seen in network brokerage (Muirhead and Woolcock 2008), although some network brokerage was evident. From this connectivity perspective, relationships are resources, leveraged or managed for cultural change, in this case to produce residual impact, and there were clearly a number of value-added connectors, that is, people making strategic use of the connections to produce outputs and outcomes, besides the lead researcher in this case study.

The effect of value-adding connection and brokerage on residual impact can be measured directly (see Table 2), through analysis of network development related to outputs and outcomes, including through an impact chain (e.g., a citation based on a project research report by an out-of-project party). Measurement of residual cultural accumulation may also

be possible from time-ordered project interactions based on enacting such leverage, such as in a social media analysis using diffusion (Falzon and Resyansky 2016). Thematic analysis also allows examination of residual impact of people who drive the formation of influential relationships, adding to evidence demonstrating individual agency and shared intentionality.

### ***How Longitudinal Planning can Optimise Residual Impact***

The notion of cultural change and residual impact may also enrich discussion of collaborative research impact measurement through consideration of longitudinal planning. Such consideration embraces measuring feedback and other iterative processes related to reciprocity of relationships, with timing of interactions a necessary factor in gauging shared intentions and goals directed towards cultural change. Although the case study was concerned with static relational structures, it considered these in a complex and dynamic process, where feedback and feed forward interactions involved all SIP members. For those members, interactions within the mediated praxis process resulted in residual cultural accumulation that could be drawn upon later, and for other needs, this being a crucial outcome of their efforts and key signs of success. Such a view is consistent with theorisation of social capital (Lin, Cook, and Burt 2001) and, as already discussed, social capital can be considered a component of cultural accumulation.

As well as the SIP member groups and individuals themselves being able to draw later on the externally stored accumulated culture created by relational approaches, other groups (neighbouring communities) were also evidenced as able to engage in a similar fashion. There is preliminary evidence that these communities, alerted to benefits of the SIP, began borrowing the network and the processes generated as project capital (also a component of accumulated culture) and using them to build their own responses. For example, a nearby community adopted some of the SIP-led initiatives in the formation and development of service initiatives that contributed to community capacity building (Keast et al. 2009;

Muirhead and Woolcock 2008; Woolcock and Boorman 2003). The proposed framework provides for a longitudinal view of residual impact, through process iterations, that accommodates measurement seen in adoption of project outputs and outcomes, as was the case here.

### ***Residual Impact in the Light of Emerging Impact Frameworks***

Residual impact, therefore, may look in part like the impact described in current frameworks (e.g., REF 2014), but the suggested re-conceptualisation offers a deeper dimensionality to impact, more in tune with literature such as Blackstone, Hage, and McWilliams, (2016) which also offer examples of residual impact that may require a cultural accumulation perspective in order that the full impact measurement is accurate in a creative or innovative ecosystem. Reach, for example, could be seen as reach across society directed towards residual cultural accumulation, with residual impact as determination of how many people were influenced through a given cultural change. Reach may be able to be extended conceptually to also include residual impact available from time sequence data analysis, including from citation analyses but also other sources that can track-cultural change and residual impact across interactions not directly concerned with a research project, including twitter feeds and other social media mechanisms. Significance could also be related to measures of residual impact— cultural change is brought about through collaborative interaction.

Residual impact measures may also call upon the growing interest in longitudinal analysis of dynamic interaction and relational structures, particularly in the recent focus on the Internet as a locus of social processes, spreading ideas and forming social communities. New techniques for representing and analysing dynamic processes have been developed from approaches that model the sequence in which interactions and relationships unfold temporally (Spiro, Acton, and Butts 2013), giving a more exacting longitudinal analytic

than the snapshot approach taken in the current case study. This modelling has proved useful in studying conversation threads in micro-blogs and social networking online, to explore change and influence in the short rather than the long term (Falzon and Resnyansky 2016). Such an analysis of social media as a medium (locus or tool) of cultural change and residual impact does require, however, shifting focus from structure to interaction, and from source and content of the means of influence to the actual effects manifested by certain kinds of observable reciprocated response, both online (e.g., email responses or re-tweets and mentions) and offline (e.g., social actions). Exploration of change and influence by these means, however, does add a potential extra dimension to the discussion of residual impact and resultant residual cultural accumulation within the broad context of cultural learning seen within university-non-university collaborative research networks.

Measures, therefore, may need to include a component of user engagement with research outputs by counting the number of views, shares, saves or even media coverage an output receives (Marcella et al. 2015), the documentation needed to determine the effect of engagement on cultural learning, for example through backward and forward process tracing (Ruegg and Jordan 2007). It may well be, however, that since data may need to be collected as a project unfolds, process tracing may be the most intensive, but thorough, way to measure cultural change and any resultant residual impact, since process tracing requires documentation of all project interactions (Beach and Pederson 2013).

## **Conclusion**

In this case study, person-person interactions that led to development of internally accumulated culture (memories), as well as person and group interactions with externally accumulated culture, were integral to the research project's sustainable development. The resulting residual impact was also evidenced directly, not only by reports and other

communications, but also by available records of behavioural change of the participant groups, such as collective strategic planning, active management and leadership as well as upholding current agreements. Indirect evidence (available from the researcher) was also available, for example, as documentation of strategies and leadership meetings as well as meeting reports and other outputs resulting from team activities (Table 2). There was additional and acknowledged explicit recognition of the need for fundamental change in relationship networks, evidenced by the success of the university education and training dedicated to relationship and function development. Interactions within the case were dynamic, not static or ‘one off’, and relied on the continual feed forward and feedback processing that would be typical within the proposed framework. A change in thinking is required to re-conceptualise impact so that it takes on board these deeper considerations, including how dynamic interactions might be affected by the feedback of indirect measures, as in the case study here.

One question that remains concerns whether, if the case were situated in a context less, or not at all, based on research collaboration, would this affect the means for measuring impact in the proposed way. In any cultural learning context we would argue that one would expect some degree of cultural accumulation, given that this is what Tomasello’s (1999; 2014) conceptualisation is focused on, though in the reality of the research collaboration context there may (or may not) be cultural change and therefore may (or may not) be residual impact as a result. The mechanisms of collaboration may therefore influence the impact, but not the means for measurement of it—a focus on residual impact assumes that cultural change has occurred in any case.

The concept of residual impact enlarges the scope of impact as currently viewed, such that due importance is given to examining human interactions through various types of communication (including reading and conversation) that are the essential basis of the

research collaboration itself. Residual impact also demonstrates the ‘value add’ of research—beyond knowledge making by one group to a more collective, accumulating form of knowledge making. Importantly, the case study examined here supports consideration of a dynamic view of measuring residual impact in terms of system processes, as well as change and innovation, as Patton (2010) has argued.

This article therefore argues that: (a) residual impact provides an additional and important overarching framework for measuring impact DURING the process of the research collaboration itself; (b) that residual impact can be evidenced by the cultural artefacts that are produced through collaboration within cultural learning contexts; and, (c) that residual impact can lead to an enduring and measurable cultural accumulation, that is DEEPER than current measurement methods would show.

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Table 1. A summary of data collection methods and rationale, participants and analytics

<b>Data collection method</b>	<b>Participants (number)</b>	<b>Foci</b>	<b>Rationale for method used</b>	<b>Analysis</b>
Informal semi-structured interviews (x 1)	Key sectoral informants (21)	Interview of key informants from both government and community sector (not directly involved in the cases) selected for their experience and understanding of the sector.	Provided insights into the overall context and processes that have evolved overtime (positives and negatives), drivers and personal lessons learnt.	Qualitative: Manual thematic analysis as well as analysis in Nudist and/or NVivo
In-depth semi-structured interviews (x 3) - repeated twice throughout study & post	Key SIP informants (4)	Interview of four key members of SIP (manager, leaders & facilitators) most central in the operation (directly involved in cases)	Provided detailed insights on history and operation of SIP, the project's operating context, as well as personal experiences and perceptions including perceived wider benefits .	Qualitative: Manual thematic analysis as well as analysis in Nudist and/or NVivo
Questionnaire (x 2)	Full SIP membership (19/20 members)	Based on an integration and network measurement instrument developed initially by Provan and Milward (1995, 2001) and later used by others (e.g., Raab and Kenis 2009)	Provided detail on drivers for working together as well as benefits for individual organisations and collective impact. Included information on process of integration, governance modes, and time working together.	Qualitative: Manual thematic analysis as well as analysis in Nudist and/or NVivo (95% response rate)
Network Linkage Survey (x 2) - embedded within the questionnaire above	Full SIP membership (18/19 members)	As above but focussed on information for Social Network Analysis (SNA)	Provided information for SNA as follows: with which organisation do you share: information; resources; joint projects; and, joint committees.	SNA (e.g., Minerlink & UCINET): density, centrality, descriptive multiplexity & tie type, direction (95% response rate)
Focus group (x 2), 12 months apart	Full SIP membership (18/20 members)	SIP members were provided with opportunity to provide individual reflections—four took this up and provided extensive documentation. Interviews were coded and added to the qualitative project material	Provided (1) understanding of members experience in and understanding of SIP and its operation, perceived successes and failures, participation facilitation, and the role of government (2) source of rich insight on facilitation processes (regular use of group discussion and experience in learning events predisposed members to self reflection).	Qualitative: Manual thematic analysis as well as analysis in Nudist and/or NVivo

Table 2. Summary of measurements and how they could be used to document residual impact, based on the continual measurement process of the SIP and CSRC (examples summarised from Woolcock and Boorman 2003; Muirhead and Woolcock 2008)

<b>Direct Measurements (accessible to community or government)</b>	<b>Indirect Measurements (researcher interpreted from non-public artefacts)</b>
<b>Outputs (tangibles)</b>	<b>Outputs (tangibles)</b>
Reports, and other publications and communications, e.g., learning stories, websites (Goodna.net), measurement tools and protocols (markers of integration, modelling tools), a Regional Information Warehouse	Examination of meeting notes and minutes and other outputs resulting from team activities, including documentation of strategies and leadership meetings, e.g., SIP Update for community forums and group workshops
Teaching and learning outputs, e.g., enrolments and awards in purpose-designed and accredited university programs (Grad. Cert. Interprofessional Leadership), short courses, learning events, action learning projects	Interviews and surveys to determine exposure of students to community-based and university-based learning experiences
Associated projects, e.g., Goodna Pool, Integrated Family Support, SIP Jobs Forum)	Interviews and surveys to determine exposure of community members to community-based learnings, as well as promotion of learning processes
Invitations to participate in national government expert committees and international forums, such as to provide policy advice: government policy changed as a consequence; and, impact on other service delivery networks	Analysis of the relevance of existing data and measurement tools, e.g., noting a shift to a focus on network analysis for examination of community-centric relations
<b>Outcomes (intangibles, including behavioural)</b>	<b>Outcomes (intangibles, including behavioural)</b>
Accounts of collective strategic planning, including identification of key people and agencies and resource allocation processes	Interviews and surveys to determine shared language (continues) and agreed ways of working, as well as other social capital related to social effects
Active management and shared or distributed leadership, e.g., SIP Measurement and Modelling Group’s determination of integrated measurement tools, such as community wellbeing & cost-benefit models	Examination of changes in the way government and government funded agencies do business, including alignment of priorities and aspirations, e.g., for SIP in the Goodna community—Integrated Family Support
Upholding current agreements, e.g., “doing what we know we should” (Muirhead and Woolcock 2008, 1)	Examination of relationships embedded within the structure and operation of the services that remained localised within the area as a type of residual collaborative capacity and practice (e.g., intra-community relationships)
Examination of the effect of value-adding connection and brokerage, through analysis of network development related to outputs and outcomes, including through an impact chain (e.g., citation based on a project research report from an out-of-project party), as well as through thematic analysis that examines interactions of people driving formation of influential relationships	Examination of new local governance models and regimes which change the way in which government representatives interact with each other, and change the dynamics of the community and services sector (e.g., based on location rather than specific programs in SIP)

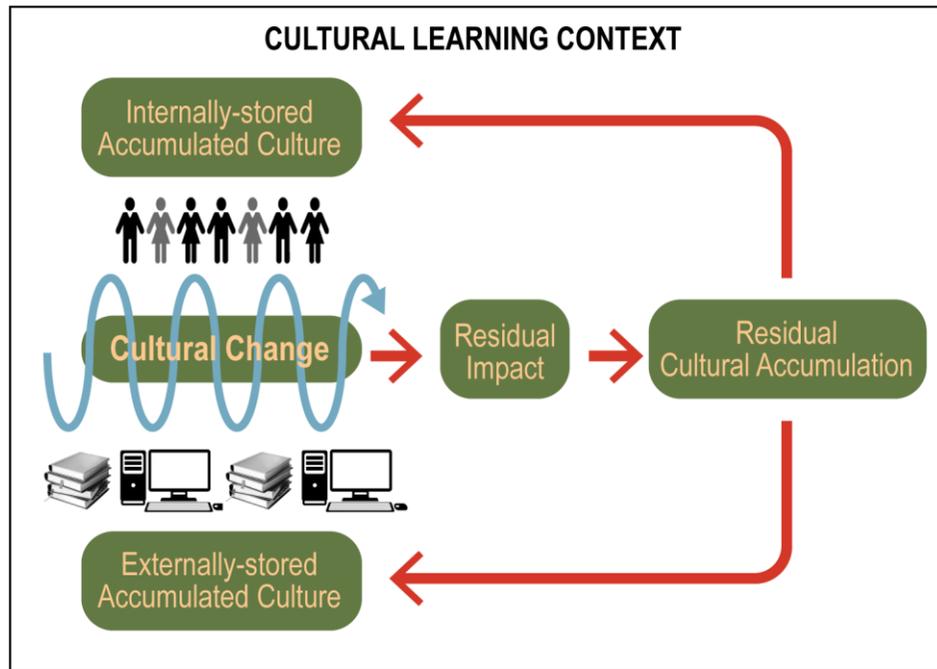


Figure 1. Residual impact and residual cultural accumulation in the cultural learning context of a research collaboration

