AUTHOR(S): FREMANTLE, C., GULARI, M.N., FAIRBURN, S., HEPBURN, L.-A., VALENTINE, G. and MEAGHER, L.

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Impact by Design: Evaluating knowledge exchange as a lens for evaluating the wider impacts of a design-led business support programme

Chris FREMANTLE[a], Melehat Nil GULARI[*a], Susan FAIRBURN[a], Leigh-Anne HEPBURN[b], Gail VALENTINE[c], and Laura MEAGHER[d]

[a] Robert Gordon University, Gray's School of Art; [b] Glasgow School of Art; [c] University of Dundee, Duncan of Jordanstone School of Art and Design; [d] Technology Development Group

This paper reports on the evaluation of knowledge exchange and impact generated through Design in Action (DIA), a design-led business support approach to answering the Arts and Humanities Research Council's call for knowledge exchange hubs.

Can evaluation approaches to knowledge exchange reveal the complexity of impacts from design-led business support? Does design have a particular set of methods and processes relevant to knowledge exchange? To address these questions the paper draws on both interview and Survey material, and uses Nutley/Meagher Prism to analyse the emergent data. Nutley/Meagher Prism enables us to see different aspects of something in process which is otherwise indistinguishable, just as a prism enables us to see different wave lengths of light manifest as the colour spectrum.

The paper addresses the interests of multiple stakeholders including economic development agencies, research councils, arts and cultural development bodies as well as design researchers and knowledge exchange intermediaries through demonstrating the multi-faceted value of design-led business support approaches to knowledge exchange programmes.

Keywords: *Design-led business support; Knowledge Exchange; Impact*

[*] Corresponding author: **Melehat Nil Gulari** | e-mail: **m.n.gulari@rgu.ac.uk**

Introduction

Design-led business support programmes aim to demonstrate the value of design to business and to position design as a strategic resource (Gulari, Fairburn & Malins, 2013; Raulik-Murphy & Cawood, 2009). These programmes are conventionally measured by their economic impact but this is recognised as insufficient (Swiatek & Whicher, 2016; Gulari, 2014; Whicher et al., 2011; Tether 2005).

Design in Action (DIA), resulting from the Arts and Humanities Research Council's call for Knowledge Exchange Hubs in the Arts and Humanities, is a design-led business support programme but rather than simply putting designers together with businesses, it is focused on the role that design can play enabling and shaping knowledge exchange to achieve economic impact.

DIA has multiple stakeholders with different priorities not all of whom are solely interested in the economic dimension. Some have interests in learning, the wider recognition of the value of design, or the promotion of collaboration across disciplines and sectors as well as new knowledge.

Knowledge exchange is recognised as an important mechanism for connecting knowledge production (assumed to be within the academy) with knowledge use (assumed to be outwith the academy – even in the 'real world'). Obviously this dichotomy is contentious. Instead, DIA focuses on the co-creation of knowledge between academics, practitioners, social and commercial enterprises and communities.

Various models for the evaluation of knowledge exchange and its impacts are emerging. Much work has been done in the sciences and social sciences and as far as we are aware none in art and design.

The aim of this paper is to report on the testing of one particular model (which we are calling the Nutley/Meagher Prism) for evaluating knowledge exchange as a means to better understand the impact of DIA, potentially contributing a stronger framework to the evaluation of other design-led business support programmes (although obviously they are not all driven by a knowledge exchange agenda).

We have drawn on two main data sources in order to test the model. Ideally an evaluation of a design-led business support programme or KE programme (or hybrid such as Design in Action) would develop its data gathering process focused by the model, rather than retrofitting the model to existing data.

Nonetheless, we have found that the model is very helpful in revealing impacts in a number of key areas including learning, the wider recognition of

the value of design, and the promotion of collaboration across disciplines and sectors. Furthermore, we have been able to identify some interactions across types of models that may illuminate others' evaluations in the future.

Design-led Business Support

Design-led business support programmes have emerged in the recent years as a result of government's investments to promote design as a strategic resource for innovation and business growth (Gulari, 2015). The Design in Action (DIA) programme, one of four AHRC funded knowledge exchange hubs, is delivered by a consortium of 6 universities in Scotland. Its main objective is to support businesses innovation through design. Since its launch in 2012, DIA has focused on five key sectors of the Scottish economy: Food, Information Communications Technology, Wellbeing, Sport and Rural Economies (DIA, n.d.). DIA takes a structured approach including running residential design-led knowledge exchange workshops, which bring businesses, designers and academics together in order to generate innovative ideas around specific sectoral calls. We call them *Chiasma*, which means "ideas meeting at the point of creation". DIA employs co-creation and participatory innovation (Sanders, 2002) methods to achieve its aims. Following a Chiasma, participants develop ideas and apply for funding from within DIA of up £20,000. Selected ideas are further supported by the hub team to be launched as businesses. There are other networking and knowledge exchange activities outwith the Chiasmas, such as public talks, several business showcases and two Scottish Design Summits (DIA, n.d.).

Since its inception, DIA has actively sought to explore and understand the notion of knowledge exchange between enterprise (commercial and social) and academia, in particularly focusing on ways in which academic institutions can understand the different sectors noted above as a means to identifying and working with potential knowledge exchange partners. DIA approaches knowledge exchange processes with strategic, creative 'methods' for working collaboratively to generate innovative ideas (Baillie & Prior, 2014; Kearney & McHattie, 2014). In the early stages, research focused on the notion of scoping, with Prior and colleagues (2013) looking at the approach of audience research as a way to make informed decisions about the design of those services. Scoping is a participatory activity aimed at identifying critical challenges and the key stakeholders for a given sector (Woods, Marra & Coulson, 2015).

Knowledge Exchange and Impact

The Arts and Humanities Research Council (AHRC) defines knowledge exchange (KE) as "a co-production of new knowledge through the interactions of academics and non academics, individuals and groups, which is of benefit to both parties and is distinct from the one way dissemination of research findings" (AHRC, n.d.). DIA has adopted a nuanced aim: "Design in Action, however, proposes a framing of KE that is evidenced by impact, and therefore defines KE as the co-creation of new knowledge *facilitated by design* through the interaction of academics, business, individuals and communities, it is achieved when value is manifest" (Woods et al., 2015) [Emphasis added]. Whilst the AHRC definition recognises that KE generates benefit for both parties, the DIA evolution focused on bringing together design-led business support with KE, highlighting the importance of value being manifest. Where the AHRC version implies that it is a two way exchange, the DIA version understands that there might be multiple parties each experiencing different manifestations of value. The most significant refinement is the specified need for facilitation of the process and the use of design by DIA as the facilitator.

Impact can be defined as "the demonstrable contribution of research to changes that bring benefits to the economy, society, culture, public policy or services, health, the environment or quality of life". With the Research Excellence Framework, articulating economic, social and cultural impact of research has become very important in the academic community in the UK (Simon et al., 2011). KE activities are seen as a means to increase the impact of research to the extent that KE is central to the narrative of impact generation.

Munro (2016) claims that there are only a handful (e.g. Moreton, 2013, Moreton, 2015; Williams, 2012; Williamson et al., 2011) of studies addressing theoretical debates through empirical examinations of 'actually-existing' KE, despite the many academics working on such projects in the UK.

One significant issue identified in the literature is that KE activities do not always lead to direct or immediate commercial benefit or tangible outcomes. Meagher (2013) describes KE impacts as "…elusive, subtle, diffuse…" and notes the "…long-term nature of these impacts."

Another challenge is that the metrics for success for a design-led business support programme tend to be conventional instrumental impacts including new business formation, growth of business, and employment

generated. DIA, although funded as a KE programme, followed these type metrics at the outset (Follett & Marra, 2012). Despite the fact that the quantitative analysis has tended to be regarded as more reliable than the qualitative analysis by many disciplines and government agencies (Tether, 2005), applying quantitative analysis is not sufficient to evaluate the full impact of design interventions (Tether, 2005; Gulari, 2014).

Ways of evaluating the impact of Knowledge Exchange

There are a range of different models for evaluating KE and its impact. DIA has generated a model focused by design, utilising aspects of the 'double-diamond' (Design Council, 2005). Other models have been generated seeking to understand key factors in KE.

The DIA KE Process Model proposes a five-stage process, namely scoping, interpretation, ideation, formation, and evolution, brought about by both external and internal participation (Wood et al., 2015). It provides a descriptive account of the Chiasma process.

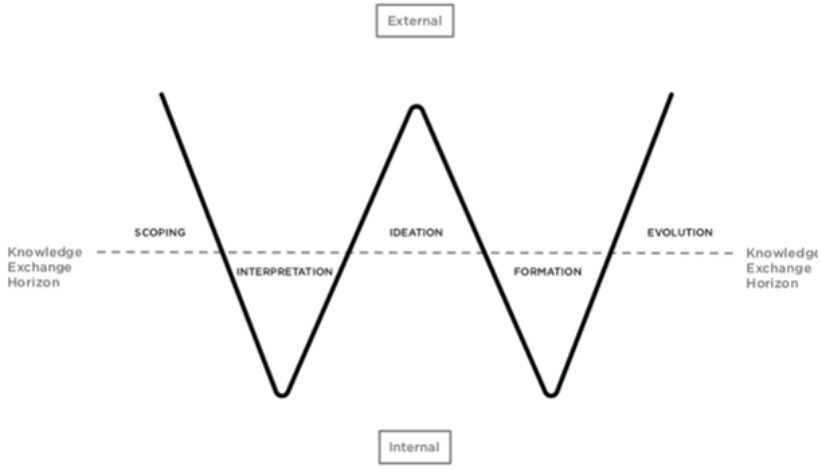

Figure 1 Design in Action Knowledge Exchange Process Model

KE models outwith design provide different perspectives as a result of their specific interest. Bozeman (2000, p.637), for example, developed a framework that presents the five dimensions of technology transfer environment. These dimensions include agents, objects, media, recipients and the 'demand environment'. A more relational model of KE is presented

by Munoz-Erickson and Cutts (2015). Their study focuses on the relationship between knowledge and power in a knowledge-action network, recognising that knowledge flows may privilege some types of knowledge over others as a result of distributions of power.

Meagher's approach to the evaluation of KE focuses on the formative (rather than summative) value of evaluation to "…inform future undertakings by researchers, research managers, knowledge intermediaries and research funders" (Meagher, 2013). Meagher and her colleagues have iterated a framework (Meagher, 2009; Meagher & Lyall 2013) that builds on Nutley et al. (2007) based on a number of categories of impact resulting from Knowledge Exchange activities. Nutley et al. (2007) initially identified three forms of impact: 'instrumental', 'capacity building' and 'conceptual'. Meagher (2009) added two additional categories of impact: 'attitudinal/cultural change' and 'enduring connectivity'. Table 1 presents the Nutley/Meagher Prism with the following short descriptive quotes and phrases to unpack the sense of the categories.

Table 1 Nutley/Meagher Prism Categories of Impacts of Knowledge Exchange informed by Nutley (2007)

Impact	**Description**
Instrumental	"direct impact of research on policy and practice decisions" (Nutley et al, 2007)
Capacity Building	"this can refer to education, training or even development of collaborative abilities" (Nutley et al, 2007)
Conceptual	"where research changes ways of thinking, alerting policy makers and practitioners to an issue or playing a more general 'consciousness-raising role'" (Nutley et al, 2007)
Attitudinal or Cultural	"positive changes in institutional cultures and individual attitudes toward knowledge exchange" (Meagher & Lyall, 2013)
Enduring Connectivity	"when researchers and prospective users stay in contact even after a funded project ends." (Meagher & Lyall, 2013)

Further reflection on these forms of impact (change and growth) confirm that they can they provide an effective spread of quantitative as well as qualitative perspectives.

Instrumental impacts are defined as impacts on practice in terms of ways of working or on policies, regulations and standards that in turn affect ways

of working. Instrumental impacts almost by definition lend themselves to quantitative measurement, and certainly in terms of DIA and design-led business support programmes are likely to be understood in terms of economic impacts and specific policy instruments.

Conceptual impacts describe the ways research can change our understanding of a subject and is in turn closely linked to *Capacity-building impacts* which is more learning focused.

A*ttitudinal/Cultural change* focuses on positive cultural or attitudinal change amongst research participants towards collaboration and knowledge exchange. Are the participants in KE, whether knowledge producers or users, more positively predisposed towards working with people in other positions within the system?

Enduring connectivity refers to lasting relationships between knowledge producers or users. It is important because enduring connectivity is more likely to result in effective feedback loops, mutual understanding and co-creative work. It focuses on building trust and long-term relationships.

The whole approach, particularly focusing on formative evaluation, is significant in terms of capturing subtle indicators, factors and roles and identifying a wide range of types of impacts and focuses on the unfolding of impacts over time.

Using the evidence available from DIA we will explore what the Nutley/Meagher Prism reveals about design-led business support programmes.

Research Design

To test the model we used mixed methodologies and drew on both qualitative and quantitative data. In addition to Key Performance Indicators (KPIs) established at the outset and monitored throughout, the two main elements of evidence that have been used for this study are the DIA survey of participants (n=46) undertaken in 2015, comprising both quantitative and qualitative data, and semi-structured interviews (n=17) conducted during 2013-2015. This data triangulation ensured the trustworthiness of the findings (Patton, 2002). That being said it is worth noting that most of the authors are working on the DIA programme and the academic/educational perspective might be perceived to be dominant. The following sections describe how data was collected and analysed.

Data gathering

Since the programme began in June 2012, DiA has involved hundreds of individuals from design, academia and businesses (either already in social or commercial enterprises or wishing to establish new enterprises) in its seminars, workshops, annual Design in Business summits and residential Chiasmas. The 14 Chiasma events themselves had in excess of 300 participants.

DIA's KPIs

DiA's KPIs fall into three categories: capacity building/events, impact (income generation, jobs created, and businesses launched), and academic activity. As per its most recent KPI's dated December 2015, it has funded 17 projects, with 13 (76%) predicted to launch, and 4 business already launched with turnover exceeding £2m. Through its design-led support, it has created 107 jobs thus far and generated over £670K of external partnership funding/support for the projects. Finally, DIA has generated 7 trademarks (registered or filed) and 1 patent, led to £550K of additional design research grants and funding and its activities and outputs have led to over 50 research papers, publications and conference presentations.

The DIA Survey

The DIA survey was a self-completion online survey (Timba Surveys) managed by one of the authors (Valentine). A survey link was emailed to all Chiasma attendees (n=209) on June 9, with a reminder email being sent on June 17, 2015. The survey closed to responses on June 19 at 4.00pm. The survey was incentivised with a prize draw for a £200 Hotel voucher. 46 people completed the survey (23.80% completion rate). The participants of the survey were designers (23%), design/business (23.9%), business (15.2%), design/academic (10.9%), academic (8.7%), business/ academic (6.5%) and other (10.9%)[1].

1
The other responses were: Freelance marketer, recent design graduate, researcher, unsure, and can't remember

The questions of the survey were developed by considering the Nutley/Meagher Prism to some extent but also focused on evaluating the effectiveness of initial KPIs, DIA operations and programme delivery. The survey included both quantitative and quantitative questions to explore different forms of impact.

Interviews

The Interviews were undertaken by one of the authors (Hepburn) as part of a PhD sponsored by DIA. They were semi-structured, face-to-face and participants were asked about three main themes:

- The Chiasma Experience
- Networks and collaboration
- Innovation and reflection

The seventeen Interviews referred to in this study comprised of six design professionals, four academic professionals and seven business professionals, all of whom participated in a Chiasma event. The Interviews were conducted between September 2013 and May 2015, lasted an average of 70-90 minutes and were recorded and transcribed.

Data analysis

We are sharing the method of analysis because it demonstrates ways to interrogate a range of data to establish the value of the Nutley/Meagher Prism and to make the case for valuing the wider impacts of design working in the context of commercial and social enterprise innovation.

We focused our analysis on coding three open-ended questions of the survey, as they are the most relevant questions to address the research questions (See Table 2 below).

Table 2: Questions, focus in relation to framework and notes on number/quality of responses

Question	Focus	Breakdown of 46 Responses
9: "If you have started a business or developed a business idea, in what way (if any) did attending the Chiasma / Design In Action assist?"	Relationship between the instrumental impact (starting a business) and other forms of impact.	12 participants did not answer this question, 2 provided answers that did not indicate any forms of impact, and 5 stated that it made no difference. 27 provided detailed answers.
11: "In what ways did attending a Chiasma(s) change your understanding?"	changed 'understanding' interpreted to focus on 'capacity building'	18 did not respond, 1 negative statement, 1 no, and 1 neutral ("most of the learning I already knew, but re-learned"). 25 positive answers, 15 of which gave specific and detailed answers, allowing us to interpret cross-over impacts.
19: "Is there any other way that attending a Chiasma event has benefitted you personally or professionally?"	open-ended question allowing a wide range of different responses	11 did not answer, 2 answered in the negative (i.e. that attending the Chiasma didn't benefit them) and 1 did not indicate any forms of impact. 32 meaningful answers.

We analysed the complete and meaningful responses to these three questions in two teams separately. As part of the coding process, we generated some keywords referring to the different types of impacts. An example of coding process is illustrated in the figure below.

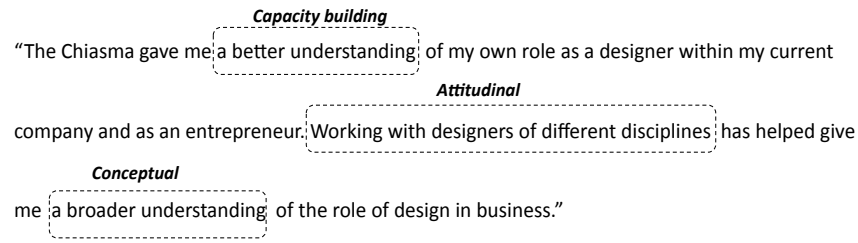

Figure 2 Example of the coding process

As we will see below, this generated a number of insights. We further used the keywords generated from analysis of the survey to analyse the all interview material using NVIVO software (See Appendix for the set of keywords).

Insights and analysis

Our main focus in the analysis has been to understand how the Nutley/Meagher Prism reveals different aspects of value. We first present a range of types of impacts before moving on to the linkages across types of impacts.

Interpreting Incidents

Table 4 presents a quantitative analysis of the results of the coding exercise on the qualitative survey questions (Q9, Q11 and Q19) and Table 5 presents a quantitative breakdown of incidents of the different aspects of impact derived from Interview analysis.

Although Meagher's (2013) findings from a meta-analysis of evaluations suggest that instrumental impacts are consistently the lowest reported, our findings appear inconsistent with this. While in interview findings, it appears that 'instrumental' impact is the least frequently observed type of impact (See Table 5), Table 4 indicates otherwise. Within the survey, participants noted the full range of impact types (with the exception of 'enduring connectivity' in Q11).

Table 4 Incidents of impacts for Q9, Q11, Q19

	Q9		Q11		Q19	
	Team 1	Team 2	Team 1	Team 2	Team 1	Team 2
Capacity Building	11	18	22	17	12	19
Instrumental	N/A	12	1	11	8	8
Conceptual	6	12	11	11	6	7
Attitudinal	6	4	5	5	19	12
Enduring Connectivity	1	5	0	0	9	10

Table 5 Incidents of impacts derived from interviews

Interview Respondents	Capacity building	Instrumental	Conceptual	Attitudinal	Enduring Connectivity
D1	4	1	2	2	4
D2	5	1	3	4	4
D3	3	2	4	5	2
D4	5	3	3	3	2
D5	2	2	4	2	3
D6	2	2	3	2	1
SUM	21	11	19	18	16
AVERAGE	3.5	1.8	3.1	3	5.3
A1	2	1	1	3	2
A2	3	1	2	1	2
A3	1	3	2	1	4
A4	2	1	2	2	3
SUM	8	6	7	8	11
AVERAGE	2	1.5	1.75	2	2.75
B1	3	1	2	2	2
B2	3	1	2	3	1
B3	3	2	2	3	4
B4	2	2	1	4	1
B5	3	1	4	6	1
B6	2	1	3	2	2
B7	6	6	5	2	3
SUM	22	14	19	22	14
AVERAGE	3.1	2	2.7	3.1	2

D stands for Designers, A for Academics and B for business representatives

Linkages-Interactions

During the analysis of the Survey the teams focused on linkages between different impacts as manifest in the way questions were answered. To understand these linkages we generated Spiderdiagrams (figures 3a, 3b and 4) which highlight how different types of impacts are tied up together. For example, *conceptual* and *capacity building* may be interconnected, or *instrumental* impacts and *attitudinal change* may build on *capacity-building*. Math allows 26 different combinations[2], however in our analysis, we have identified 15 of them.

Figures 3a and 3b provide visual interpretations of the linkages between the categories of impact. Using 5-axis spiderdiagrams, the incidents of the various linkages were plotted for Question 11 and Question 19. The frequency of incidents is expressed as line-weight, thus those linkages with more incidents are weighted with a heavier weight line. Two-way linkages are shown as spanning two axes with a continuous line and this approach is carried on for three-way and four-way linkages. This visualisation approach was chosen to convey patterns in the associations between categories. It is confirmatory that the two teams independently identified similar linkages, thus affirming they interpreted and applied the categories of impact in a consistent manner.

2

Number of combination of size k from n variables:
n! / r! (n - r)!
\sum_{r_i=2, r_i<=5} (n! / r_i! (n - r_i)!)

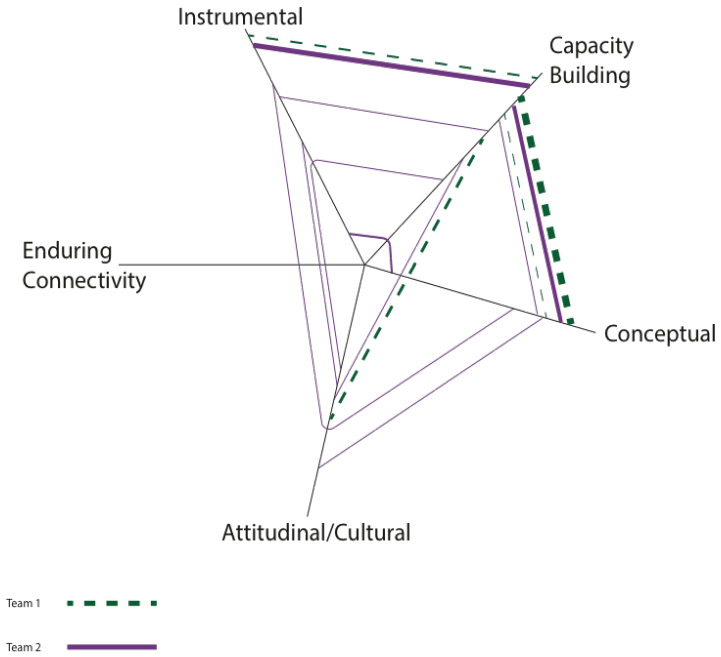

Figure3a Spiderdiagram showing linkages between impact categories for Question 11: "In what ways did attending a Chiasma(s) change your understanding?"

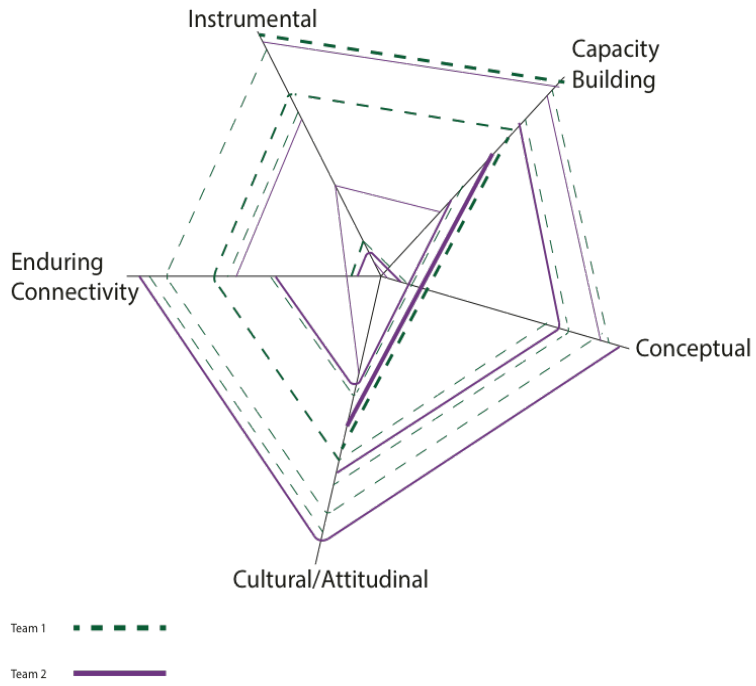

Figure 3b Spiderdiagram showing linkages between impact categories for Question 19: "Is there any other way that attending a Chiasma event has benefitted you personally or professionally?"

Figure 4 further explores this idea specifically looking at how different forms of impact are tied to instrumental impact, drawing upon the responses to Q9. By placing instrumental impacts central to the other four categories, we see the nature and distribution of linkages.

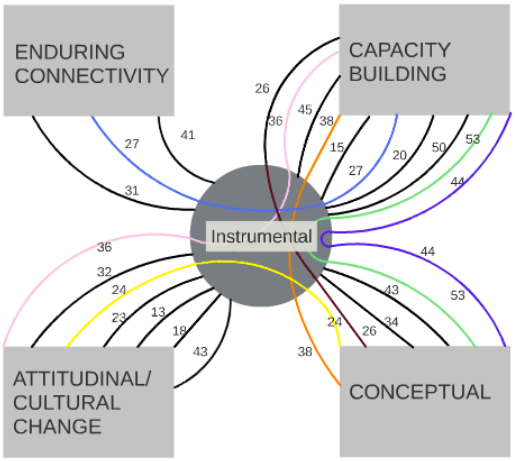

Figure 4 Showing how instrumental impact is tied to other types of impact Question 9: "If you have started a business or developed a business idea, in what way (if any) did attending the Chiasma / Design In Action assist?"

The figures (above) indicate that participants often (though not exclusively) reported experiences of impact in clusters and as linked. Multiple respondents to the survey linked Capacity Building and Cultural/Attitudinal in their answers to Q19. It is especially interesting that in different configurations and with different frequency, almost every area of Knowledge Exchange impact was linked with one or more other areas. When asked in Q9 about benefits associated with instrumental impacts, again all other areas were mentioned with greater or lesser frequency.

As shown by Figure 4, capacity building and conceptual impacts are interwoven and this is further confirmed by the way that people responding to the survey phrased their comments, as the following quotation illustrates; *"Gaining further understanding about the Blockchain technology and its potential was certainly an 'aha!' moment"*.

Although one might expect conceptual impacts lead to attitudinal/cultural impacts, we noticed that the way responses were phrased suggests that attitudinal impacts appear to lead to conceptual impacts, for example, *"…Working with designers of different disciplines has helped give me a broader understanding of the role of design in business"*

Based on Figure 4, which is developed from a small sample and not necessarily reliable, it is interesting that in coding respondents' comments,

we noted relatively few comments about *enduring connectivity*. Yet when asked about remaining in contact in Q5 where there were only yes/no/don't know options 64% of respondents checked the 'yes' box.

During our analysis we wondered if these linkages are linear i.e. one things lead to another, or these connections are more complex and formed loops or nests (Figure 5).

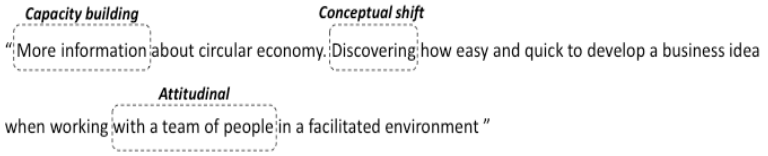

Figure 5 Analysis of Quotation-Survey

As seen in Figure 5, the way this answer is phrased places what appears to be a conceptual shift "Discovering how easy and quick it is to develop a business idea" in between "More information" (which we interpret as a capacity building impact) and "working with a team of people" (which we interpret as a positive attitude to collaboration).

In another example, in this case a response to Q19 is seen in Figure 6,

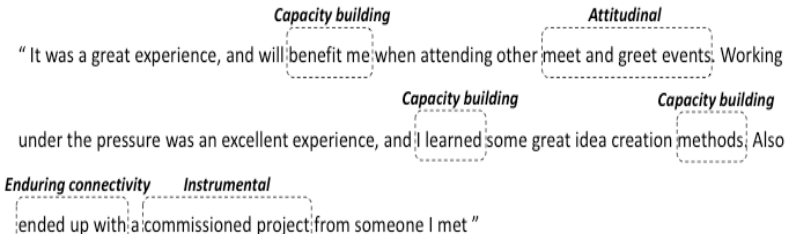

Figure 6 Analysis of Quotation-Survey

The articulation starts with referencing capacity building ("benefit me") linked with a positive attitude towards to developing new working relationships ("meet and greet events"). The respondent then goes back to the learning ("I learned…methods") and finally implies that a relationship developed during the Chiasma became enduring connectivity ("ended up with") leading to an instrumental impact ("commissioned project") (Figure 6).

To achieve instrumental outcome, it may be that one experiences the other impacts in the lead-up.

Our findings resonate with Meagher (2013), who in reviewing 4 evaluations indicates that five types of impacts are seen in each case study and these impacts are often interwoven and maybe interdependent.

It is worth noting that other evaluations conducted using the Nutley/Meagher Prism show different proportions of impact. Meagher's evaluation of the Rural Economy and Land Use (RELU) programme finds higher levels of 'enduring connectivity'. That programme was very much driven by an emphasis on interdisciplinary research as well as knowledge exchange with stakeholders in domains beyond industry, including farmers, policy makers and the public, where DIA is driven by an emphasis on innovation for SMEs and micro businesses. This might lead one to speculate that these underlying intentions shape the profiles. There was a lot less evidence of enduring connectivity coming out from the DiA analysis, compared to that observed in the context of her impact evaluations. This suggests each programme might have a distinctive profile of types (and degree) of impacts. Considering an 'aspirational profile' could then inform the way a new programme might develop in order that it better achieves the intended outcomes.

Analysis revealed that collaborative action is not uniformly positive, nor were impacts achieved for all participants. It is possible for participants to feel excluded or that their ideas are neglected. As illustrated by the following quotation from the survey. *"I saw an opportunity, but the energy and wisdom in my group and interest from the chiasma support team was in a different direction."* "*It was interesting to meet people even if it did not spark lasting connections. And the exercises were good if too many."* While not within the scope of this analysis, we observed a few negative comments about DIA operations and delivery. Evaluating the operations and delivery is not within the scope of this paper; therefore, we have not provided further details.

Conclusions and implications

This paper has examined the extent to which the Nutley/Meagher Prism, an evaluation tool for knowledge exchange, reveals value within a design-led business support programme focused on generating commercial and social enterprise innovation. We have approached this research question through the analysis of data from survey and interview respondents

regarding the DIA programme, which has enabled us to see a range of types of impacts. We have also identified linkages across types of impacts. (Profiles of linkages may vary for projects with different underlying purposes.)

As we noted, there has been considerable discussion highlighting the extent to which economic KPIs are insufficient to fully understand the impacts of design-led business support programmes. We recognise the necessity of an inclusive model for the role of design in KE and innovation that speaks to the range of stakeholders in the process, including businesses, policy makers, funders (across several sectors) as well as various academic disciplines. When we acknowledge this larger group of stakeholders, we recognise that motivations of different groups are distinct, and are not exclusively economic. For example, cultural development agencies may be more interested in demonstrating the role of design in the economy (capacity building and conceptual shifts).

Although government agencies prioritise certain types of impacts such as instrumental impacts, recognising other aspects of impacts is essential to illuminate and appreciate the complexity of the situation. We also take the view that the variety of KE activities, sometimes tacit in nature, would not be reflected unless they are captured by subtle indicators.

Different stakeholders will inevitably prioritise different impacts on different timescales from design-led business support and KE focused programmes. The benefit of this nuanced method of evaluation and in particular the demonstration of the linkages between different forms of impact is to engage stakeholders in a shared and mutually supportive approach to policy formation, i.e. that Research Council policy on KE, which might prioritise capacity building and enduring connectivity, is connected with Business, Skills and Innovation investment in sectoral innovation which prioritises instrumental impacts as well as conceptual shifts.

Comparison with other design-led business support programmes indicates that DIA has delivered significant instrumental outputs of the sort typically envisioned. Whilst the evidence we have indicates that DIA delivered far more- across all of the categories of impact, it is not possible to make comprehensive comparisons of it with the other studies that Meagher has done. There are not any as yet clearly established benchmarks for KE activity beyond conventional instrumental impacts shared with design-led business support, let alone ones specifically for the Nutley/Meagher Prism.

Our analysis has also confirmed different forms of impacts are interwoven, as suggested by Meagher (2013). This study contributes to the

notion that these impacts should not be evaluated in isolation. It is not possible to see causality in these linkages. It is more likely that the picture is more emergent, that nests of impacts occur in proximity to each other: clustering and emergence rather than simple causation. In terms of these types of programmes, it can be useful to know that simple causation is not something one can plan and design for. In the instance of DiA, very few people saw no benefit to the process, so the integrated approach of the programme meant that we were achieving impact in a short time period, across a number of categories.

Our findings clearly demonstrate that there are relationships between different types of impact (or even clusters) and thus we should not look at the categories in isolation. The Spiderdiagrams show that this is complex and in the DIA case weighted to particular connections. We wonder if different types of KE projects might have different weightings, resulting in differently weighted impacts within the framework. It would be interesting to understand whether KE driven for different ends, in different domains, have different such profiles, from which we can learn. Another area of profiling that needs to be explored is the timelines of impact and the duration of impact. Meagher (2008, 2013) has begun to explore this and has found initial suggestions of this.

Our analysis has also confirmed different forms of impacts are interwoven, as suggested by Meagher (2013). This study contributes to the notion that these impacts should not be evaluated in isolation. It is not possible to see causality in these linkages. It is more likely that it is more emergent, that nests of impacts occur in proximity to each other: clustering and emergence rather than simple causation. In terms of these types of programmes, it can be useful to know that simple causation is not something one can plan and design for. In the instance of DIA, very few people saw no benefit to the process, so the integrated approach of the programme meant that we were achieving impact in a short time period, across a number of categories.

Continuing with the theme of stakeholders, the Nutley/Meagher Prism does not address the distribution of power, particularly manifest where organisations are permeable and not permeable. This relational dimension has been highlighted by Munoz-Erickson and Cutts (2015). It impacts on design-led business support and KE projects because those involved in the development of commercial and social enterprises through such mechanisms are inevitably engaged with a range of large organisations. We

suggest that future work to focus on investigating this relational dimension to further analyse the impact of knowledge exchange.

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Appendix

Keywords and phrases derived from the survey analysis

		Team 1	**Team 2**
CB	**Capacity Building** *(increased knowledge among participants/ stakeholders)*	Expanded my knowledge, Expand, knowledge Learning, learning from people, Learn from New, new approaches, new tools, manual, tool kit, exercises, Worksheets, methods Underlying technology, Gaining further understanding Being inspired, inspiring The exploration of Gave me a greater insight, insight More information Discovering In more detail Was beneficial to see Advice Increased and broadened Extended my knowledge Breadth of my understanding Added to my way of working Inspiring approach Decent reality check Opened up my understanding Inspiring talks Gave me confidence	Expanded, shared, models/strategies, information sharing, shared advice, better understanding, exploration of business models, work with, more information, business models, advice, greater understanding, increased, social enterprise model, extended knowledge, increased breadth of understanding, new business models, Opportunity to be around, snapshot of what is happening, meet & hear, more determined, design methods, added to my way of working, expertise, knowing, good contacts, design skillset, stimulating talks, shared interests, contact, sector, acting in group events, meet other practitioners, potential of (service design), interact with, exposing me to,

I	**Instrumental** use *Direct impacts, tangible, where a specific piece of research is used in making a specific decision/or solution to specific problem.*	Application for funding Contribute Wider networking circle? Great new project with funding Actions plans Commissioned project Real world environment To create a piece of work The process took 3-4 times more To use for my collection Professionally Academic paper Additional funds	Tool, manual, new tools and approaches, underlying technology, discover how easy, in more detail, bringing design process into start-up, how they might work, choose the right approach, tangible links, worksheets,Idea creation methods, commissioned project, real world environment, approach, good tip, solutions, wrote academic paper, allowed me to develop
C	**Conceptual** Indirect impact on knowledge, understanding, attitudes Conscious raising *(seeing things differently)*	Made me realize, realize, conceptual, beyond my.. Aha Moment Potential of … Take a step back broadened Aware of its existence How useful design is Even Allow me to see Stimulated thought Increased my awareness Raising awareness Changed the way I work Networking opportunity Collaborative creativity Giving me confidence Challenge Made me think a lot bigger Made me	models/strategies, aware, broader understanding, exploration, greater insight, step-back to refocus, aware, conceptual phase, broadened…concept of a new business, opportunities, stimulated thought, Contribute ideas, increased awareness, changed way I work completely, grow a movement, think a lot bigger, greater understanding of my own way of thinking, opened-up understanding,

A	**Attitudinal** *(Willingness to collaborate across sectors)*	Information sharing, Team group Working with a Team of people Working with people Engaging and inspiring people People To contribute to To meet other Meet and greet Collaboration Increased network Happy to give back Ask for help Team building Good contacts Connections made will grow Collective journey Team workshops Shared interests Contact with some interesting people Peer network A wider array of people Different backgrounds Many different personalities Interact	Learning from people, different disciplines, value of collaboration, learn from, working with a team of people,Around engaging and inspiring, design scene, meet & greet, changed the way I work completely, collaborative, ask for help, at ease, team workshops, immersive, interact with, engaging and challenging, love to experience again
EC	**Enduring Connectivity** *(lasting relationships)*	Wider networking circle Develop a core team Team building Good contacts Collaborate Introduced to the network (which already exists) Joining to the network Lasting connections Joint Partnership project	Wider networking circle, raising profile, increase network, develop a core team, team building, develop relationships, blockchain network, wrote academic paper, expanded peer network, partnership project,