COLLABORATION CALIBRATION: A FRAMEWORK FOR UNDERSTANDING RESEARCH COLLABORATIONS

A CONTEMPORARY ART AND SCIENCE COLLABORATION CASE STUDY:

LEVIATHAN

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ABSTRACT

Despite the flourishing number of art and science collaborations, very little academic consideration has been given to understanding and thus optimising the dynamics of such endeavours. In the first of its kind, this dissertation attempts to make such an undertaking. I begin by applying Sargent and Waters' (2004) framework for understanding research collaborations to the case study of *Leviathan*, a contemporary art and science collaboration inaugurated during the 57th Venice Biennale, 2017. Through semi-structured interviews with the relevant participants, I examine the influencing factors and phases of the collaboration to understand the mechanisms at play and conclude that through effective interpersonal processes, it was indeed a successful collaboration. In doing so, several limitations and shortcomings of Sargent and Waters' (2004) framework became apparent. Using emergent themes from the data as well as previous collaborative and psychological research, I propose a revised framework with nine novel contributions, including an unprecedented adaptation of Maslow's renowned Hierarchy of Needs bespoke to collaborations. Implications of these findings are discussed and possible directions for further research are identified, in the hope of contributing to the prospering discourse of art and science collaborations, expanding collaborative theory in general, and to support potential future partnerships in developing, maintaining and evaluating successful research collaborations.

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1.0 INTRODUCTION

1.1 RESEARCH COLLABORATIONS

Increasing impetus amongst academics for cross-fertilization between different fields of study has led to the rise of interdisciplinary and multidisciplinary research collaborations in recent years (Jeong & Choi, 2014). Whilst specialisation is necessary for the development of almost all research fields, it is often through sharing knowledge or skills that new insights, perspectives and ideas are generated that individuals working in isolation could not have achieved, or achieved as quickly (Katz & Martin, 1995). Collaboration, as such, is a catalyst for innovation.

The definition of collaboration is at best fluid, varying considerably across institutions, sectors, fields, countries as well as over time (Katz & Martin, 1995). Jassawalla and Sashittal (1998) define a research collaboration as, 'the coming together of diverse interests and people to achieve a common purpose via interactions, information sharing, and coordination activities,' whilst Mattessich *et al.* (2001) define collaboration to include participants '[working] together to advance their separate, yet compatible, missions.' More general definitions have been proposed to resolve such contradictories albeit at the risk of becoming too vague and unwieldy for practical purposes, such as, 'a bringing together of members from various fields to apply their expertise in successfully resolving complex problems,' (Amey & Brown, 2005). Collaborations, then, operate on a continuous scale of participant involvement and objective type unique to each case, and this ambiguity is perhaps in part responsible for the difficulty of analysing and evaluating collaborations.

Whilst there are endless forms of collaborations, they all include the common notion of synergy. As such, it has been widely accepted that research collaborations are 'a good thing' (Katz & Martin, 1995), enabling projects to benefit from economies of scale and economies of skill that are essential to tackling the complexity of society's problems (Bryson *et al.*, 2006; Agranoff & McGuire, 2003; Goldsmith & Eggers, 2004; Kickert *et al.*, 1997; Mandell, 2001; Rethemeyer, 2005). Moreover, as a result of rising economic, social, political and professional pressures, collaborations have been increasingly encouraged by universities, institutes and the government (Price, 2011). For example, just earlier this year, the UK government made amendments to their grant application process to make it 'easier for partners to work together and for that spirit of collaboration to be maintained,' (Vodden, 2017).

1.2 THE ROLE OF CONTEMPORARY ART IN KNOWLEDGE PRODUCTION

Research can be an important component of contemporary art practice. The emergence of contemporary art after the 1960s marked a stark shift in focus away from the aesthetic and toward the underlying concept of the artwork (Blumberg, n.d.). Abandoning the circumscribed purposes of traditional art, such as representation, religious glorification, and the pursuit of beauty (Wilson, 2002), contemporary artists experiment with a myriad of media and subject matters, and often engage critically in current affairs:

> *'When engaging with contemporary art, viewers are challenged to set aside questions such as, "is this work of art good?" or "is the work aesthetically pleasing?" Instead, viewers consider whether art is 'challenging' or 'interesting' … Contemporary artists are in a position to express themselves and respond to social issues in a way that previous artists were not able to.'*

(The J. Paul Getty Museum, n.d.)

The emphasis of the artwork can thus lie on the lines of inquiry the artist has chosen to investigate and portray to the public. Contemporary art, as such, has been acknowledged as an unconventional, yet substantial, form of research (Borgdorff, 2011; Hlavajova, M., *et al.* (eds.), 2008; Maharaj, 2009; Busch, 2009; Roush, 2008). Examples of contemporary artists who engage in such practice can be found in appendix A.

Moreover, there are certain characteristics of the contemporary artist that lend themselves well to carrying out fruitful research (Wilson, 2002). Traditional, academic research is subject to funding grants and, as a result, certain valuable lines of inquiry can perish due to the lack of support from funding bodies who deem them unimportant or unfavourable. The contemporary artist, however, need not abide by academic fashion and, furthermore, their propensity for iconoclasm and critical social commentary (Wilson, 2002) allows them, if not even compels them, to respond to the more challenging and provocative themes of society that others might rather avoid:

> *'"There are some specific issues that fall through the net of academic thinking, of disciplinary thinking, of established departmental thinking, which can be picked up by art practitioners." This alternative kind of inquiry does not shy away from difference or lack of clarity, leaving classical "scientific" demands for empiricism and purity aside. He continued, "in asking what systems of knowledge do not ask, one is opening space for new knowledge and in the production of that new knowledge, there you see the role of the artist-researcher."'*
>
> (Sarat Maharaj, quoted in Hlavajova, M., Winder, J. & Choi, B (eds.), 2008 p. 8)

Italian philosopher, Giorgio Agamben (1942) characterises those who are 'contemporary' as those who possess an 'out-of-jointness' with their time (Agamben, 2009). For the case of the contemporary-artist-researcher, this could be advantageous since, 'through this disconnection and this anachronism, they are more capable than others of perceiving and grasping their own time,' (Agamben, 2009). This ability to view society from a meta-level, combined with an artist's affinity for creativity and innovation (Wilson, 2002), can result in unique perspectives and approaches, making the contemporary artist a valuable researcher.

This is reflected in the ethos of the Venice Biennale, one of the most prestigious and well-renowned contemporary art fairs in the world. The Venice Biennale describes itself as standing, 'at the forefront of research and promotion of new contemporary art trends,' (La Biennale di Venezia, n.d.). Its commitment to research and knowledge production is prominent, so much so that the 55th Venice Biennale (2013) entitled *The Encyclopedic Palace*, was inspired by the 1950s eleven-foot-high architectural model by Marino Auriti (1891-1980) who envisioned his *Encyclopedic Palace* as a, 'museum in which all worldly knowledge would be documented, preserved, and exhibited,' (Radice, 2012), as shown in figure 1.

Epistemological pluralism recognises that in any given field, there may be several ways of 'knowing' that contribute to a more robust understanding of subjects (Miller *et al.*, 2008). Artists' alternative perspective, inherent creativity, and unparalleled ability to express themselves can therefore make them important contributors to research and knowledge production. After all, as Karl Popper states, 'by in principle reducing everything to monism, one seals off fruitful areas of inquiry,' (Popper, 1975).

Figure 1: Auriti's *Encyclopedic Palace* in the first room of the *Arsenale* at the 55th Venice Biennale (Cordioli, 2013).

1.3 PERFORMANCE ASSESSMENT OF COLLABORATIONS

Collaborations vastly benefit from its participants acquiring a working knowledge of collaborative theory, so that they are able to provide conditions conducive to a successful collaboration (Czajkowski, 2006). Shifting from an autonomous to an interdependent mind-set can be challenging and a collaboration framework can act as a supporting guide throughout the development of the project, encouraging sustainable and effective partnerships.

The relative novelty of the contemporary-artist-researcher, together with the intrinsic difficulty of characterising collaborations, is perhaps in part responsible for the omission of art and science collaboration assessment in collaborative research - a lacuna this dissertation seeks to address. Whilst

contemporary art has transcended the frame, I ask, can art and science collaborations be better understood when considered within one? And, if so, are the frameworks available sufficiently insightful?

Focusing on the process of collaboration itself rather than the final outputs of one, I begin by conducting a literature review of existing research collaboration frameworks. From this, I present Sargent and Waters' (2002) inductive process framework as having the most potential for understanding research collaborations. In the second section, I apply the framework to the case study of *Leviathan*, a research collaboration between a contemporary artist, Shezad Dawood, and ten experimental scientists from the Institute of Marine Sciences, inaugurated during this year's Venice Biennale. I then outline the limitations and shortcomings of the framework and use emergent themes from the data, as well as previous collaborative and psychological research, to conclude with a propositional, revised framework for understanding research collaborations, including those of unconventional nature.

2.0 LITERATURE REVIEW OF COLLABORATION FRAMEWORKS

As put forward by Rethemeyer (2005), 'part of the intellectual challenge of studying cross-sector collaborations is blending multiple theoretical and research perspectives.' To gain insight into this hilly, literary terrain, an overview of the different theoretical frameworks is thus essential.

Most of the literature investigating the success of collaborations can be broadly divided into two arenas (Suarez-Balcazar *et al.*, 2005): those that consider the *factors* affecting the success of a collaboration (Tyler and Haberman, 2002; Barnes *et al.*, 2009; Amey and Brown, 2005) and those that explore the sequential *phases* of a collaboration (Harper and Salina, 2000; Ostrom *et al.*, 1995; Small, 1996). However, for a framework to be used an effective guide it needs to address the multidimensional, interrelated and reciprocal complexities of *both* the influencing factors and phases involved in sustaining a successful collaboration (Suarez-Balcazar *et al.*, 2005).

In 2017, Bowers conducted an extensive inventory of collaboration frameworks and models, as shown in figures 2(a) and 2(b). Whilst not exhaustive, it aims rather to be 'representative' of the multitude of frameworks available, providing valuable insight into collaborative theory, especially given its recentness. From this list, I will consider the models that are applicable to research collaborations and encompass both the factors and phases of a collaboration. These are the frameworks proposed by, (1) Bryson, Crosby and Stone (2006), (2) Suarez-Balcazar, Harper and Lewis (2005), and (3) Sargent and Waters (2004). Whilst other such frameworks not on Bowers' (2017) list were consulted, I concluded that this inventory was successfully representative of the literary landscape and sufficiently comprehensive for my study[1].

[1] References to all the frameworks in Bowers' (2017) inventory can be found in the references chapter.

Author (Year)	Type of Collaboration	Model Characterization	Theoretical Framework	Contextual Factors	Model References to Conflict
Amey & Brown (2005)	University–community partnerships	Interdisciplinary collaboration model in stages	Dialogical method of inquiry	Implicit: training & rewards; cognitive constructions; leadership	Implicit throughout
Barnes Altimare, Farrell, Brown, Burnett, Gamble, & Davis (2009)	University–community partnerships/ university outreach & engagement	Iterative process wheel	Participatory research foundations	Institutional identity & institutional commitment	No explicit references
Bowen, Newenham-Kahindi, & Herremans (2010	Community engagement strategy	Continuum	Corporate philanthropy	No explicit references	No explicit references
Bringle & Hatcher (2002)	Campus–community partnerships	Phases (of relationships)	Service-learning	Exchanges; equity; distribution of power	Reference to relative dependency & power
Bryson, Crosby, & Stone (2006)	Cross-sector collaboration	Propositional inventory	Organizational collaborative planning	General environment; sector failure; direct antecedents	Contingencies & constraints

Figure 2(a): Table of collaboration frameworks and models (Bowers, 2017: p.44).

Author (Year)	Type of Collaboration	Model Characterization	Theoretical Framework	Contextual Factors	Model References to Conflict
Buys & Bursnall (2007)	University–community partnerships	Sargent & Waters's (2004) inductive process model	University engagement	Institutional issues; national & international differences in climate	Reference to disparate interests
Norris-Tirrell, Lambert-Pennington, & Hyland (2010)	Engaged scholarship	Philosophical core; internal & external forces; boundary-spanning points	Engaged service-learning	Leadership vision; external demands & opportunities; internal critical mass	No explicit references
Sargent & Waters (2004)	Academic research collaborations	Inductive process	University research	Institutional supports; resources; climate: national & institutional; interpersonal & social aspects	No explicit references
Suarez-Balcazar, Harper, & Lewis (2005)	Community–university partnerships	Nondirectional phases; interactive & contextual	Participatory action research	Potential challenges & threats; power & resource inequality; time commitment; conflicts of interest; funding	Conflicts of interest, power & resource inequality, & time commitment; budgets
Tyler & Haberman (2002)	Education–community partnerships	Continuum	Community partnerships with community perspective	No explicit references	No explicit references; insight on power and conflict throughout text

Figure 2(b): Table of collaboration frameworks and models (Bowers, 2017: p.45).

1. Bryson, Crosby and Stone's framework for collaboration (2006)

Generated from a review of collaborative theory, Bryson, Crosby and Stone (2006) present a framework for understanding cross-sector research collaborations, as shown in figure 3. Thematically organised according to the process of collaboration, they identify the salient factors that can influence each stage, as well as give explicit consideration to the potential contingencies and constraints of a collaboration.

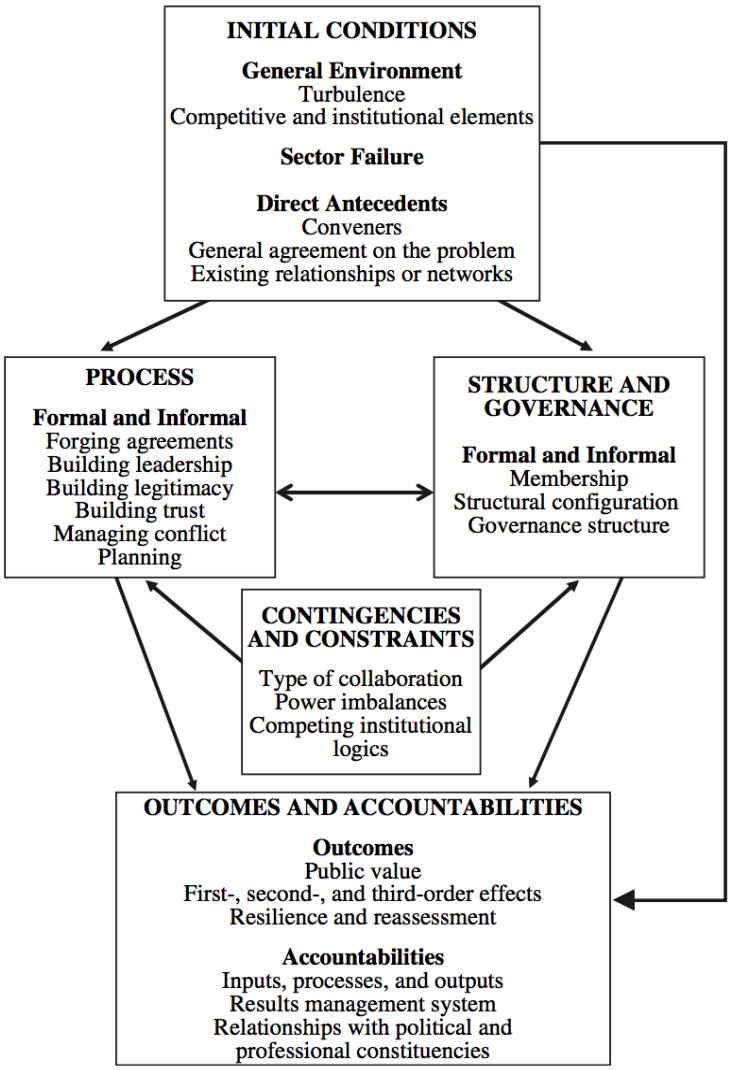

Figure 3: Bryson, Crosby and Stone's framework for collaboration (2006: p.45).

For Bryson *et al.* (2006) the initial conditions comprise the incentives for collaboration, attributing the main driving force for collaboration to arise from a 'sector failure'; the tried and failed attempt of a sector to solve a problem stimulating them to seek assistance from another sector. Whilst each of the factors mentioned in the process are indeed integral to a sustainable and effective collaboration, they only consider the dynamics within a collaboration, neglecting the peripheral yet influential factors, such as funding, time or external support.

Explicit attention is given to the potential contingencies and constraints, which include negotiation, competing institutional logics and power imbalance. However, whilst inefficiencies may arise from these features, they can also in fact be fruitful drivers for innovation, with alternative perspectives being sometimes the main incentive for collaboration. Moreover, these challenges could be alleviated by effective and communication between the participants, a factor omitted from this framework. Additionally, equal partnerships have been observed as harder to achieve than a hierarchical one (Suarez-Balcazar *et al.*, 2005) with benefits arising from strong leadership, so power imbalances may not necessarily be negative. Finally, Bryson *et al.*'s framework fails to capture the extent of interaction amongst and within the different categories, and is hence too simplistic and linear for practical application.

2. Suarez-Balcazar, Harper and Lewis' framework for collaboration (2005)

Based on previous literature and observations of prior collaborations, Suarez-Balcazar *et al.* (2005) present an interactive framework for research partnerships between universities and community-based organisations (CBOs), as shown in figure 4. The model attempts to address the factors that influence the trajectory of the collaboration, as well as explore potential challenges and threats to its success.

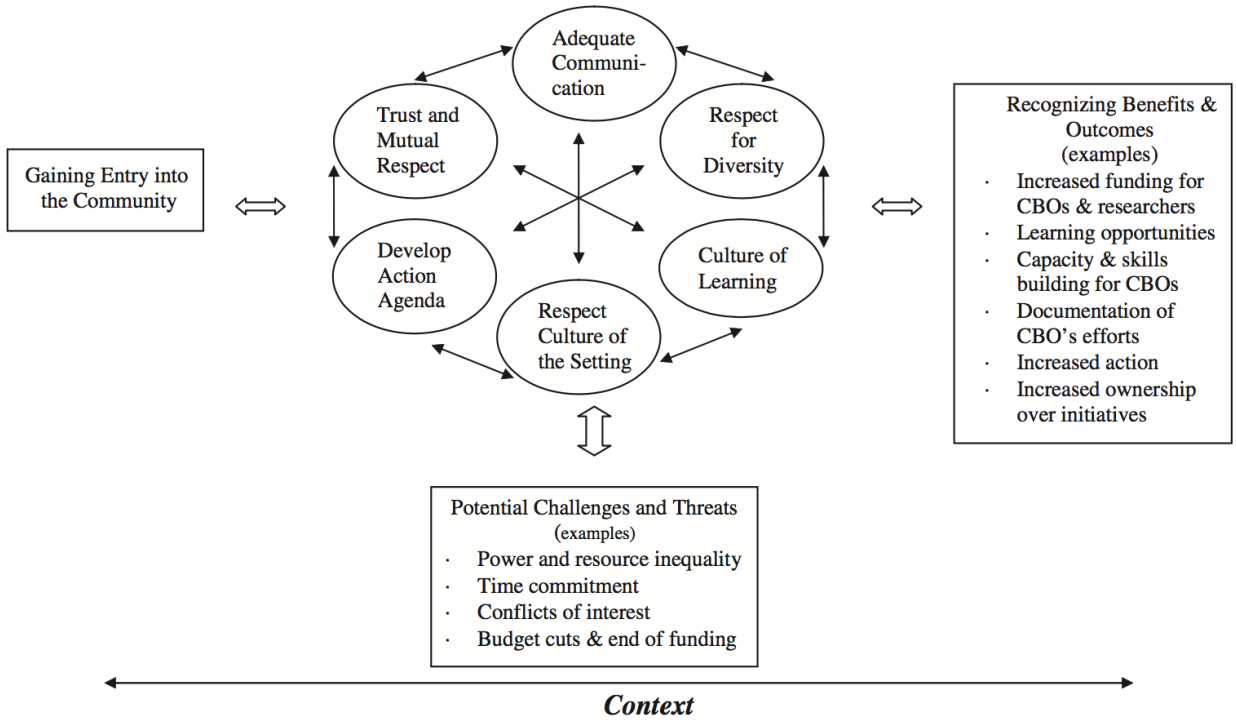

Figure 4: Suarez-Balcazar, Harper and Lewis' framework for collaboration (2005: p.86).

The main advantages of this model are its sensitivity to the interpersonal processes between collaborators and its emphasis on the interdependent, reciprocal nature of them. Each factor in the framework is said to both influence and be influenced by other factors, and its position within the model does not indicate a directional influence. However, almost no commentary is given to the sequential phases, initiation factors, and contextual factors, which all greatly affect the success of a collaboration. Moreover, although Suarez-Balcazar *et al.* (2005) highlight the possible conflicts that may arise, they do not offer strategic elements for managing them.

3. Sargent and Waters' framework for collaboration (2004)

Drawing on the experiences of three collaborations and later corroborated by a further eight case studies, Sargent and Waters (2004) present an inductive process framework that considers both the chronological phases of a collaboration as well as the factors that influence it, as shown in figure 5.

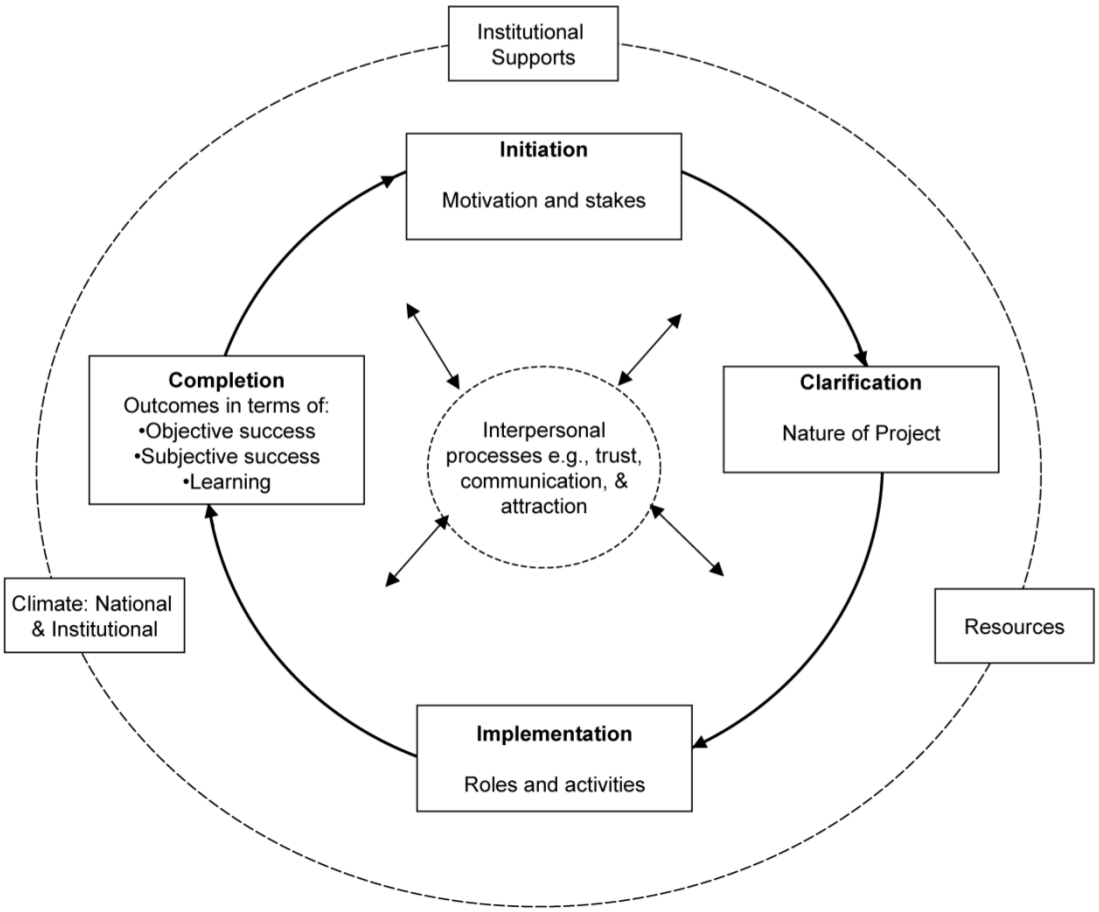

Figure 5: Sargent and Waters' framework for collaboration (2004: p.311).

Collaborations are described as going through a cycle of four distinct phases: initiation, clarification, implementation, and completion. The initiation phase focuses on the members' motivations for participating in a collaboration. These are further divided into two categories, which are not mutually

exclusive: (a) instrumental rationales, which involve collaborating for professional promotion, and (b) intrinsic rationales, which involve collaborating for personal satisfaction.

The second phase is the clarification of the collaboration, in which the type of partnership, project scope and objectives, number of collaborators and other logistical matters are decided. The implementation stage emphasises the establishment of the different roles collaborators can take on, and turns to Dalton, Thompson and Price's (1977) four stages of professional careers for definition, as shown in figure 6. At the top of the hierarchy is the *sponsor*, who has the most power and independence. They are the main leader of the project, responsible for shaping its goals, directing its activity and innovation. The *mentor* often takes on the role of a manager, implementing the decisions of the sponsor and acting as a mediator between the rest of the members and the sponsor. The *colleagues* are those who carry out tasks set by the manager independently, whereas the *apprentice*, the final position, has almost no independence. Sargent and Waters (2004) acknowledge that these roles can change throughout the collaboration and individuals can acquire multiple roles simultaneously relative to different collaborators.

FOUR CAREER STAGES

	Stage I	*Stage II*	*Stage III*	*Stage IV*
Central activity	Helping Learning Following directions	Independent contributor	Training Interfacing	Shaping the direction of the organization
Primary relationship	Apprentice	Colleagues	Mentor	Sponsor
Major psychological issues	Dependence	Independence	Assuming responsibility for others	Exercising power

Figure 6: Dalton, Thompson and Price's four stages of professional careers (1977: p.23).

The success of a collaboration is assessed at the completion stage, and has been distinguished into three dimensions: (a) objective outcomes, which relate to the output of the collaboration, for example publications, artworks, or a product, (b) subjective outcomes, which involve personal satisfaction, enjoyment, or enhanced self-confidence, and (c) learning from the other collaborators, which includes both knowledge and skills.

Sargent and Waters (2004) acknowledge that whilst each stage is influenced by the previous stage, they are also affected by the interpersonal processes at play between collaborators. These include communication, attraction and trust, and are said to be interrelated and reciprocal with the stages of collaborations as well as critical to their success.

Peripheral to the process itself but nonetheless integral to understanding a collaboration are the contextual factors. Institutional support consists of personnel that facilitate the collaboration, such as technicians, assistants, and administrators. Within resources, the emphasis is placed on financial resources. The type, duration, and amount of funding obtained can affect the scope of the collaboration as well as the dynamics between collaborators depending on where the funding came from and who secured it. Finally, the climate in which the collaboration operates can influence the initiation of the partnership, for example institutional, university or national mission statements.

Sargent and Waters (2004) take the view that there are an endless number of challenges that could present themselves at any stage of a collaboration, as well as some that are unique to the environment in which collaboration operates. As such, the framework focuses on encouraging a robust collaboration through which any challenge can be overcome, and hence does not address them explicitly.

This framework provides a clear and in depth understanding into the phases and influential factors of research collaborations. It is sufficiently general whilst still insightful, and as such has the most potential for fruitful application. Therefore, I will apply this framework to a case study to assess the success of the collaboration, as well as the framework itself.

3.0 METHODOLOGY

3.1 A CASE STUDY: *LEVIATHAN*

Case studies are used to analyse a particular aspect of a phenomenon at great depth (Bright, 1991). The constructivist approach views the employment of a case study as a check or contribution to an existing theoretical discourse (Blatter, 2008). As such, to investigate the potency of Sargent and Waters' (2004) framework, as well as the collaboration itself, I will apply it to the case study of *Leviathan*, an artistic collaboration that, 'explores the notions of marine welfare, migration and mental health and their possible interconnections,' (Leviathan Cycle, 2017).

Inaugurated in May 2017 during the 57th Venice Biennale, Shezad Dawood, a London-based contemporary artist, collaborated with specialists from a multitude of disciplines - marine science, political science, philosophy, forensic science, sociology, and psychology - to conceptually inform his artwork. Here, I will consider in particular the collaboration between Dawood and ten experimental scientists from the Institute of Marine Sciences (ISMAR) in Venice.

Dawood's 'practice often involves collaboration, working with groups and individuals across different territories to physically and conceptually map far-reaching lines of enquiry,' (University of Westminster, n.d.). When considering the current refugee crisis and mass migration, Dawood started thinking, 'almost in parallel, about the connection between the top of the sea and the bottom,' (Dawood, quoted in Judah, 2017) and soon reached out to the marine scientists of ISMAR to help inform this inquest. Through a series of discussions in the lead up to the exhibition, Dawood learnt about the scientists' research topics and used their studies to inform his artworks. The scientists also presented their

research to the public through symposia during the opening week of the exhibition, as well as published a short paper on the *Leviathan* website. These events aim to 'anchor the project,' revealing Dawood's conceptual influences behind his rather abstract artworks (Leviathan Cycle, 2017), and images of these can be found in appendix B.

When considering a case study, I must refrain from assuming that this particular scenario is representative or typical of all such cases. However, qualitative research samples are chosen deliberately based on their ability to provide in depth understanding into a phenomenon in context, rather than generalised data (Sandelowski, 1986), and hence I deemed this methodology to be appropriate for my study.

3.2 SEMI-STRUCTURED INTERVIEW

During the opening week of the exhibition, I conducted a semi-structured interview with each of the scientists after they completed their talk so that they could reflect on the collaboration *in toto*. This was also the most opportune way to gain face-to-face access to all the scientists in Venice. I also conducted a semi-structured interview with Dawood after the exhibition opening. All interviews were recorded with consent and transcribed verbatim to facilitate analysis and avoid selective memory bias. Prior to the exhibition opening, I met with Dawood and the exhibition curator, Alfredo Cramerotti, on several occasions to gain some preliminary background information about *Leviathan*.

Studies investigating human experiences and relationships lend themselves best to a qualitative research methodology (Creswell, 2003; Huxham, 1996) since it enables the data to operate at depth, accommodating for elaborate and complex responses (Bright, 1991). As well as verbal communication,

face-to-face interaction allows for the researcher to pick up on interpersonal features of the interviewee, including facial expressions, gestures, and tone of voice. I therefore conducted a semi-structured interview so that I could take note of behavioural cues and adapt my questions accordingly. The less rigid format of this research method also allowed for more flexibility, giving me the freedom to stray from the interview guide of prepared questions and ask supplementary, probing questions exploring new but related lines of inquiry (Bright, 1991).

The semi-structured interview can be a fruitful technique when striving to test a hypothesis that is based on a theoretical framework found within the relevant literature (Bright, 1991). Although this research technique is typically focused and deductive, at the risk of obtaining lengthy, unstructured responses, I ensured that all the questions asked were sufficiently open-ended, indirect, and general to remain as neutral and unassuming in my inquiry as possible. Moreover, I did not want to restrict data collection to Sargent and Waters' (2004) framework exclusively, but allow for the possibility of obtaining data that operates beyond the scope of the framework, perhaps suggesting its limitations or shortcomings. Although interviews can never be absolutely impartial (Bright, 1991), I deemed this to be unproblematic for my study since the inherent subjectivity of the interview supports the intrinsically social nature of collaborations.

3.3 THEMATIC CODING AND DEDUCTIVE ANALYSIS

The corresponding analytic approach to the constructivist view has a strong deductive element since it begins with theories and assesses their comparative strength in understanding and explaining empirical cases (Blatter, 2008). A thematic approach to coding and analysing the data was therefore deemed suitable for this study as it provides a systematic way of closely inspecting data, classifying it into

themes, and searching for patterns of experience. As such, the contextual factors, interpersonal processes and the four phases of a collaboration as suggested by Sargent and Waters (2004) were chosen as a list of *a priori* themes for deductively coding the data.

3.4 GROUNDED THEORY AND INDUCTIVE ANALYSIS

Employing semi-structured interviews, as well as keeping interview questions open-ended, enables me to also conduct an inductive inquiry aimed toward theory construction. Rooted in Glaser and Strauss' *grounded theory* (Charmaz & Bryant, 2008), I will establish any recurring themes in the data untended to by Sargent and Waters' (2004) framework, in order to avoid omitting any notable findings that go beyond the scope of the framework, illuminating its limitations.

3.5 ETHICAL CONSIDERATIONS

Qualitative research methods involving interviews and case studies are reliant on trust, and so informed consent and the right to withdraw is paramount (Silverman, 2013). The anonymity of all the scientists who participated in the study can be retained, however, since there is only one artist in the collaboration, permission for his identity to be revealed was essential. Awareness of my intention to be constructively critical and investigate *Leviathan* as a case study objectively was important. Further details of my consideration to ethical issues can be found in appendix C.

4.0 ANALYSIS

Leviathan cycled through phases and factors akin to those suggested by Sargent and Waters' (2004) framework. However, recurring yet neglected themes in the data revealed the limitations and shortcomings of the framework, posing the opportunity for additions and refinements to the framework to be proposed.

Quotes from the interviews conducted with the scientists and artist are used here to illustrate the themes that emerged from the data. The letter 'S' is denoted in front of quotes taken from a scientist's interview transcript, and an 'A' is denoted in front of the quotes taken from the artist's interview transcript. Full transcripts of all the interviews conducted can be found in appendices D-N.

4.1 CONTEXTUAL FACTORS

Collaborations are influenced by the context and environment it operates in as well as those that the participants originate from (Buys & Bursnall, 2007). The amount of funding, institutional support, and the ambient climate can all influence the motivations, expectations and, hence, agendas of the respective collaborators. It is therefore important for these to be addressed and understood by all the participants in order to avoid conflicts of interest.

Resources

The entirety of the funding was secured by Dawood and his team from a variety of different sources. These included private donors, patrons, galleries, and other public institutions (Leviathan Cycle, 2017).

Institutional Supports

In the case of *Leviathan*, there was no external support from ISMAR.

Climate

ISMAR is part of the National Research Council (CNR), the largest public research institute in Italy (CNR, 2016), who consciously encourage science communication:

> *'Part of the CNR activities are devoted to the dissemination of science, with the aim of stimulating public knowledge and excitement around the research activities of its scientific community. These activities include the organization of scientific travelling exhibitions and events addressed to the general public, as well as specific initiatives targeted to schools.'*
>
> (CNR, 2017)

This is known as the institute's Third Mission and can be fulfilled in different ways. *Leviathan* provides an opportunity for the scientists to engage in such an activity by serving as a platform for the communication of their research through a public talk and online publication.

4.2 COLLABORATION PHASES

Initiation

The scientists' motivations for participating in *Leviathan* were varied. Instrumental rationales, those pertaining to a professional promotion, included the desire to fulfil the institute's Third Mission:

> S: *'It's part of our job, our work. I work for the National Research Council [CNR] and there is something that we always cite. It's called the Third Mission of the institute, of the CNR. The First Mission is to research, advance, and the Third Mission is dissemination.'*

However, as Sargent and Waters' (2004) cautioned, intrinsic and instrumental incentives are not mutually exclusive and many of the scientists' and artist's motivation for collaborating could be considered in both categories. This included the desire of the scientists to broaden their perspective (intrinsic rationale) which may also lead to a positive effect on their research (instrumental rationale):

> S: *'I think we also should to learn one from each other. Because strict scientists are sometimes quite, I would say, they go strict, strict but they do not exactly know where they arrive. Whereas sometimes you need, so called, side-thinking, you know, lateral ideas that open new, definitely new pathways.'*

> S: *'When you are in the middle of a specific research field, experiences like this are very important because they broaden your mind and maybe drive a change of direction.'*

Other scientists wanted to improve their communication skills (intrinsic rationale) which may also promote the institute (instrumental rationale):

> S: *'Both I and the institute [agreed to participate] to derive from this experience to learn new ways to convey what we are doing.'*

> S: *'These are beautiful occasions to enhance my communication skills. Also looking at how [Dawood] solves some problems in transmitting messages. The use of images, the use of things, the use of us.'*

Dawood seeked to obtain knowledge of marine science (intrinsic rationale) to conceptually inform his artwork (instrumental rationale):

> A: *'Scientists were always a key component of the project. It was the science that led a lot of my research.'*

Although the motivations for collaborating differed between the scientists and artist, they were nonetheless complimentary. Most of the incentives identified fell into both the intrinsic and instrumental rationale categories, perhaps indicating a lack of distinction in Sargent and Waters' (2004) framework.

Clarification

As professed by Dawood himself, clarity is not a feature present in his artistic practice from the outset:

A: '*With most of my projects nobody really gets what I'm doing, including me I should add, because I don't like to fully get what I'm doing because then what do I get out of it? You know, until it's there.'*

Conversely, scientific research is characterised by systematic methodologies, and this disparity in approach was acknowledged by some of the scientists:

S: *'Shezad has this very artistic approach so that was a little bit unclear at the beginning for me. Being a scientist, I needed a goal. What are we expecting, what should be the outcome. That was not given actually. And then I realised that we need to leave it open and see what will come out from our collaboration.'*

This uncertainty may have raised some concern for the scientists, however through remaining open-minded and respectful of each other's approaches, they were able to accept the characteristics of the other discipline.

Implementation

Using Dalton *et al.*'s (1977) stages of professional careers as a distinguishing guide, clear roles can be observed between the participants of *Leviathan*. Dawood was the sponsor of the collaboration, having the most influence in defining the nature and shaping the direction of the project. When visiting ISMAR, Dawood was presented with all the different research topics of the institute from which he chose those

he deemed most interesting for the project. Additionally, characteristic of the project sponsor (Dalton *et al.*, 1997), Dawood brokered relationships between participants of *Leviathan*:

> A: *'Some people, interestingly enough, through my research were put in touch and that just felt like, 'oh there is a role for an artist to play in the world', in terms of brokering relationships that then hopefully might flower.'*

It was Dawood's side of the collaboration that secured the entirety of the funding and so, as suggested by Sargent and Waters (2004), the sponsor is usually reflected by who secured the financial resources. There was one scientist who took on the role of a mentor throughout the project, acting as a mediator between the other scientists and Dawood:

> S: *'I helped in various ways in building and creating a connection between the researchers of the institute and Shezad. I have been conveying to my colleagues the ideas of Shezad from the very beginning and try to return to Shezad with possibilities of collaborations from my colleagues.'*

The remaining scientists were either colleagues or apprentices. Whilst each scientist had their own area of specialisation, some were advised by Dawood's team on the presentation of their research. This included for example, restricting the use of a PowerPoint presentation during their talks and editing their online submissions to make them more accessible.

Although the exact activity of the scientists may not have always been defined, the status of their role within the project was clear from the outset. There was a comprehensive distribution of roles and

collaborators seemed to stay within their role boundaries, both of which are factors conducive to a successful collaboration (Sargent & Waters, 2004).

Completion

The objective outcomes, those referring to the output of a collaboration, for the scientists were in the form of a public talk and online publication. In creating these, the scientists also practiced and perhaps improved their communication skills, fulfilling both the subjective and learning outcomes:

> S: *'I think that it was a beautiful opportunity for me as a researcher to investigate new approaches to communicate the importance of my research but also research generally. I think that it is important for scientists to challenge, accept the challenge that different context require. I am very happy with the experience with Shezad and what this project offered me.'*

> S: *'Now that I left the PPT [PowerPoint presentation], I feel like I can do anything!'*

The objective outcome for Dawood consisted of the production of films that were conceptually influenced by the scientists' research. In producing these, he also learnt about marine science, fulfilling the subjective and learning outcomes:

> A: *'[Collaborating with the scientists had] a major impact on my thinking because as I said earlier, I was interested in this terrain and where these overlaps might occur but I needed the scientist to actually, almost to fill it in.'*

A: *'The public programme felt like such a wonderful, wonderful, you know, it exceeded my expectations. I felt I learnt so much from it.'*

Although they manifested themselves differently, all three types of outcomes were achieved for both the scientists and Dawood, and as such, *Leviathan* was a successful collaboration according to Sargent and Waters (2004) framework.

4.3 INTERPERSONAL PROCESSES

Trust

Blomqvist's (1997) seminal study on 'the many faces of trust' defines trust between collaborators as, 'the mutual confidence that no party to an exchange will exploit the other's vulnerability,' and, 'the firm's belief that another company will perform actions that will result in positive outcomes for the firm as well as not take unexpected actions that result in negative outcomes.' This issue was raised by one of the scientists, before expressing their praise for the final product:

S: *'We were chatting a lot about what could be done with [my research] but then you trust someone, you give something to someone and you sort of trust this person to do good work or a good outcome. I really had this feeling that I feel this work. I also feel a part of myself or what I would like to say in this particular outcome … that for me was very, very fruitful.'*

Communication

Most of the scientists longed for more frequent contact with the artist:

> S: *'I wish we had more opportunity to really talk about science and art.'*

> S: *'A tree does not grow in one week only because you water it three times a day. You need some time and it takes some time. We should have more time or more frequentation, more chance to spend time together.'*

However, it seems the discussions they did have with each other were very productive, albeit sporadic:

> S: *'But I really liked our conversation and his questions were very much opening the space and that was very useful and fruitful.'*

> S: *'When you are talking with [Dawood] you really find that he is interested in what he is listening to without expecting a specific conclusion from you. He doesn't listen to you because he has already a theory to prove, but he is just listening to see what will happen.'*

The lack of time, proximity and access to each other was thus made up by effective dialogue, perhaps suggesting the importance of quality of communication over frequency.

Attraction

Overcoming obstacles such as these may also in part be reinforced by the collaborators' mutual attraction or fondness for one another:

S: *'Shezad is a fantastic person in my view, and also the team is a very nice team.*

S: *'Shezad is a fantastic artist and is also a concerned artists about the planet. I see that he is sincere. He is really trying to do something.*

S: "*[Shezad] was very kind."*

S: "*I like Shezad."*

A: *'I'm actually just having a conversation with somebody I'm interested in.'*

Ultimately, it was through the fostering of these interpersonal processes that obstacles and potential clashes were overcome or entirely avoided in *Leviathan*. Through attraction and effective communication, infrequent contact was resolved, and through mutual trust and respect, uncertainties and contrasting methodologies were sustained. Therefore, congruent with Sargent and Waters' (2004) study, strong interpersonal processes between participants are fundamental to the success of a collaboration.

5.0 TOWARD A REVISED FRAMEWORK

Whilst application of Sargent and Waters' (2004) framework was useful in understanding the processes and factors present in *Leviathan*, a number of limitations and shortcomings of the framework became apparent which I will attempt to account for by making several additions and alterations to the framework. Drawing on the emergent themes from the data of the case study *Leviathan*, as well as findings from previous collaborative and psychological research, I propose nine novel contributions to the framework.

5.1 PROPOSITIONAL REFINEMENTS

1. Initiation

The success of a collaboration is hinged upon understanding the motivations and expectations of the participants since these directly influence their agendas (Tyler and Haberman, 2002). These must be acknowledged and aligned, or at least complimentary, to avoid conflicts of interest arising that inhibit the progression of the collaboration. Sargent and Waters' (2004) distinction between instrumental and intrinsic rationales does not seem to be sufficiently nuanced to fully understand participants' incentives, hence giving little insight into their multifaceted and diverse driving forces. Moreover, as revealed through inductive coding, there were many reasons for participating expressed by both the artist and scientist that did not fall into either category.

Instead, I propose to turn to Maslow's renowned Hierarchy of Needs, as shown in figure 7, to provide a more detailed insight into collaborator incentives. First published in *A Theory of Human Motivation*

(1943), Maslow describes human needs through a five-tiered hierarchy: physiological, safety, love, esteem, and self-actualisation. There have been many adaptations of this theory, particularly in business and social science (Zalenski & Raspa, 2006), and here I propose another iteration bespoke to understanding collaborators' motivations, as shown in figure 8. Although they are arranged in a hierarchy of prepotency, with the most basic needs at the bottom, a motivation does not need to be fully satisfied before moving onto the next one but rather only sufficiently satisfied so that the next motivation emerges (Maslow, 1943).

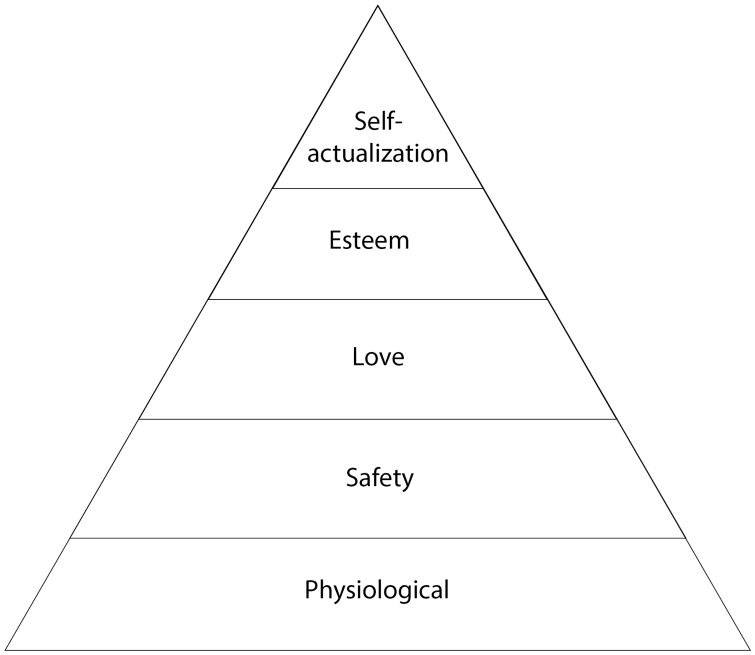

Figure 7: Maslow's Hierarchy of Needs.

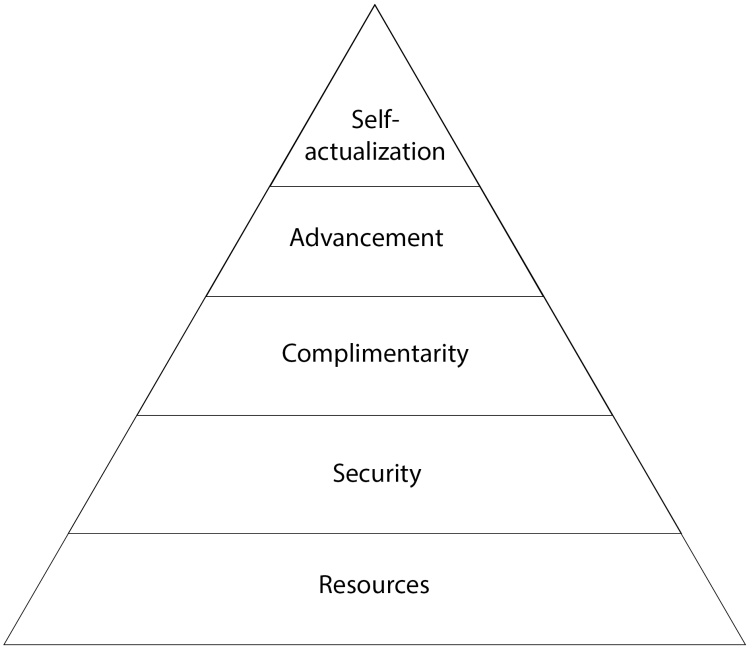

Figure 8: Adapted version of Maslow's Hierarchy of Needs bespoke to research collaborations.

Analogous to Maslow's physiological needs are the **resources** that participating in a collaboration might unlock. These could include funding grants, access to specialised equipment or data, access to particular archival media, institutional support, governmental support and so on. For Dawood, collaborating with the scientists came closely associated with the opportunity to use the former headquarters of ISMAR, *Palazzina Canonica*, as the main location for the exhibition. *Palazzina Canonica* was bequeathed by Senator Pietro Canonica (1869-1959) to the CNR on the condition that it would be used only for scientific purposes. ISMAR originally used the site as their research centre but have since outgrown it and moved to a second location, leaving the site vacant. It's history, waterfront access and proximity to the *Giardini* of the Venice Biennale (where the 29 national pavilions are located) make it an ideal location for an exhibition, contributing to the artist's incentives to collaborate.

Whilst the scientists did not receive any financial resources from the collaboration directly, some scientists viewed *Leviathan* as a means to obtain funding from elsewhere, hence incentivising them to collaborate:

> S: *'I am paid by taxpayers because I have a grant. I am doing a postdoc but they pay me also to hand out what I know. So that is a more selfish reason. In order to keep receiving the grants to do research … the public must perceive that it is something useful, that it is something good.'*

> S: *'Many times, particularly in Italy, we complain that politicians do not support science, do not give money. But I think we are also in part responsible for this. So to let a broader public understand what we do and how important what we do is, it is important to blend. Blend languages and blend with people coming from different perspectives.'*

Notably, the lack of direct funding was described as the main deterrent for other scientists not participating in *Leviathan*:

> S: *'Basically there is no reward … lots of people are saying why should I do this for free.'*

This is consistent with Maslow's (1943) hierarchy of prepotency. The dissatisfaction of the most primary need acted as a barrier to entry for some scientists. For the scientists that did participate, these needs must have been sufficiently satisfied elsewhere so that the scientists could consider higher ranking needs.

The second tier, **security**, considers the measures in place that could ensure participant job or income stability in a collaboration, for example a contract or memorandum of understanding. Additionally, as Maslow (1943) states, 'other broader aspects of the attempt to seek safety and stability in the world are seen in the very common preference for familiar rather than unfamiliar things, or for the known rather than the unknown.' Therefore, consistent with previous collaboration research (Buys & Bursnall, 2007; Sargent & Waters, 2004), prior experience of working together can also be a motivating factor for professionals to collaborate. In the case of *Leviathan*, the two parties did not know each other beforehand, however there was a letter of agreement outlining the terms and conditions of the collaboration.

The next motivation I propose is **complementarity**, pertaining to the sharing of skills or knowledge between collaborators. Artists are renowned for their creativity and capacity for self-expression, which the scientists in *Leviathan* wanted to learn from to enhance their communication skills. Meanwhile, the scientists possessed knowledge about marine welfare that the artist wanted to learn from to conceptually influence his work.

According to Maslow (1943), esteem refers to the furthering of one's 'strength', 'achievement', 'adequacy', 'reputation', 'prestige', 'recognition, attention, importance or appreciation,' the same for which is applicable to the potential **advancement** incentive in collaborations. This can present itself in the form of personal promotion, such as increased recognition and publishment, or research development, such as the furthering or expansion of knowledge. The latter was observed in both the artist and scientists, who were incentivised by carrying out interdisciplinary research:

S: *'As the general motivation, I am the kind of scientist who was brought up with a strong belief in inter- and multidisciplinary approach … It was clear to me that the way that the knowledge proceeds in our modern society was going from very peak, peak direction in specialty. And between the peaks you have very deep valleys where basically the knowledge is missing and sometimes it's much more rewarding, much more useful, or at least to me much more interesting to work in trying to level up the distance between two peaks than proceeding at the pinnacle of knowledge.'*

A: *'We're so used to kind of this sort of academic notion of separative disciplines, and I was, I am always quite curious about what we lose by doing so, in terms of not connecting different disciplines and where a sort of hybridised research might actually take things forward … In that way, I think I'm just very committed to new knowledge.'*

Lastly, **self-actualisation** refers to the realisation of fulfilment and is unique to each individual's potential (Maslow, 1943). Self-actualization 'is not necessarily a creative urge although in people who have any capacities for creation it will take this form,' (Maslow, 1943) and this was observed in both the artist and scientists. For Dawood, creative endeavours were at the forefront of his motivations to collaborate, whilst for some scientists, *Leviathan* also presented an opportunity for them to also be creative:

S: *'It is always useful to interact with artist. It opens the other part, the other half of the brain. We tend to switch off half our brain, the imagination, fantasy, the abstraction, the artistic part of us, and having an artist in front opens, switches on the brain from standby.'*

Other scientists described *Leviathan* as an opportunity to explore their philosophical inclinations about the affinity between art and science:

> S: *'[Art and science] both require the skill of imagining what is not directly touchable. They are two different ways of getting the same point. But I think this is a common perspective. It is very interesting to know how an artist, Shezad is a good example, get the same point, the message of climate change, migration. This is very interesting. My way of investigating this problem is different but we often came across many points of crossover.'*

> S: *'It seems like a trend now, they are trying to find a link, connection between science and art, etc. But look, the point is, we lost the connection. Once it was the same stuff … science, like art or like religion if you like, go through the creation and revelation.'*

> S: *'The point is when art becomes science? Absolutely there is a connection. Also because art in my opinion it tries to see the reality in a different way starting with what you feel.'*

> S: *'[Art and science] are very different but they are similar in origin. What is similar in both is they both have a relation to the experience of being surprised. You may be surprised by a set of data that you cannot explain, you can be surprised by two colours put together in a clever way. But it goes always to your feeling.'*

As revealed by the adapted version of Maslow's Hierarchy of Needs, both the scientists and Dawood had a variety of different reasons for collaborating, spanning all five motivational categories. The only incentive common to both parties was 'advancement', the furthering of interdisciplinary knowledge,

however, although the other motivations were different to each other, they were not conflicting but in fact complementary, mutually promoting the satisfaction of the other's expectations.

2. Completion

As put forward by Czajkowski (2006), 'at the outcomes stage, collaboration success is measured by assessing whether the expected outcomes defined at the precondition stage were met.' Rather than using the success measures proposed by Sargent and Waters (2004), I propose evaluating the success of a collaboration systematically according to the fulfilment of the expectations of collaborators as laid out in the initiation phase.

In *Leviathan*, every expectation outlined by both the artist and scientist was fulfilled[2]. Dawood described obtaining access to the *Palazzina Canonica* as a "huge breakthrough," and all the scientists were able to communicate their research to the public through a variety of media. A letter of agreement was devised ensuring both parties are content with what the collaboration entails, which was adhered to. Diverse skills and knowledge were shared between the parties, filling gaps that their own sector does not necessarily cater towards, namely marine science knowledge for the artist and communication skills for the scientist. New connections between marine science and migration were made, contributing to interdisciplinary knowledge, and lastly both parties experienced and produced something creative. Therefore, according to both Sargent and Waters' (2004) framework as well as this adaptation of Maslow's Hierarchy of Needs, *Leviathan* was a successful collaboration.

[2] Except for one scientist who, when asked what did he expect from the collaboration, replied, "A beer! That I have not got already!"

This way of evaluating the success of a collaboration does not explicitly address the outputs of the collaboration. However, evaluation of the output, whether it be a journal paper or artwork, is unique to the environment in which the collaboration operates and thus is subject to different assessment criteria, such as bibliometrics or art critique, respectively. Therefore, as mentioned at the commencement of this dissertation, this study considers the dynamics of a collaboration rather than its final products, since I argue that assessment of such matters defy generalisation and hence frameworks, requiring evaluation on a case-by-case basis.

3. Reflection

Both Dawood and the scientists referenced or speculated about the effects of the collaboration after the opening week:

> S: *'I am really curious how this will affect myself and my colleagues … When you are experiencing something so complex you can always get surprised by the final results so I'm really curious to see and discuss with my colleagues this experience, trying to maybe do better in the future or to try and understand what we missed and what we would like to work more on.'*

> A: *'It's been interesting some of the email conversations I have been having with the scientists after the exhibition. It has been quite interesting and illuminating.'*

Therefore, I propose to include a deliberate 'reflection' stage at the end of the cycle in which the process, outcomes, and future effects of the collaboration can be discussed, since it is important to

understand the accomplishments or pitfalls of a collaboration so that potential future collaborations can be optimised. This has been acknowledged in previous collaboration research (Bryson *et al.*, 2006; Czajkowski, 2006; Gray & Wood, 1991), and is especially relevant in the case of *Leviathan* since this collaboration was the first of a three year project in which Dawood intends to continue collaborating with other scientists from other institutes.

4. Agility

Furthermore, not only do I propose reflection at the end of a collaboration but I suggest continual reflexivity throughout its duration, as opposed to the linear progression suggested by Sargent and Waters (2004). Whilst it can be important to establish clear objectives at the outset of a collaboration, the process of how they are achieved, and in fact the nature of the goals themselves, may vary throughout the collaborative process. This was observed in *Leviathan* by both the scientists and Dawood:

> S: *'I must say that everything happened while building it. I met Shezad from the very beginning of this collaboration because in the beginning he was just looking for a place where to start building his project and I must say all the cooperation grew along the path.'*

> A: *'So it's this very interesting way in which the project progressed, expanded, it wasn't so linear, there was ways in which I would speak to someone and go, 'here, speak to someone else'. Maybe they'd be in touch, maybe they'd put me in touch with a third party. Somehow the thing would expand so it became very generative. That would be the key*

word I would use. That, you know, each sphere, it was sort of mutually influencing and expanding the other.'

Although perhaps the artistic methodology is more inclined to a non-linear progression, this fluidity has been acknowledged in other collaboration case studies of varying disciplines (Barnes *et al.*, 2009; Czajkowski, 2006). Buys and Bursnall (2007) describe university-community collaborations as 'cyclical and iterative in nature, as opposed to linear,' and Bryson *et al.* (2006) suggest that cross-sector collaborations in general are more likely to succeed when they 'engage in regular reassessments.'

Adopting the notion of agile development from software engineering (Cockburn & Highsmith, 2001), I suggest collaborations should be iterative and incremental, involving frequent feedback loops and continuous re-evaluation. Throughout the process of a collaboration, unforeseen issues, disagreements or alterations are likely to arise that require clarification or frequent revisitation to previous stages. Therefore, it is important to be flexible and able to accommodate for change accordingly.

By acknowledging that collaborations are seldom linear but rather tend to cycle back and forth, action steps can be implemented to minimise conflicts, such as regular communication, ongoing review, and transparency. This is especially important in cross-sector collaborations where participants' frame of references can be different so continual checks could help to keep agendas aligned, or at least not conflicting, as the project evolves.

5. Time

I propose to dissect Sargent and Waters' (2004) umbrella term of 'resources' into its constituent parts, namely time and funding, as each different resource has sufficiently distinct effects on the collaboration to warrant their own individual investigation. Time is a finite resource that can greatly influence the roles the participants play in a collaboration. Sargent and Waters (2004) observed this is their case study, commenting that 'time was an important factor in who did what and when,' however they did not accommodate for this in their proposed framework.

In *Leviathan*, Dawood was fully devoted to this project, spending most of his time working on it, whereas it was peripheral to the main activities of the scientists, which were described as being very demanding:

> *'You don't really have time at work. It took me time to organise the [presentation and publication]. I would say a couple of days of work, spread over 6 months, which is not much but it does take time which you don't really have to spend on things like this. I mean you have deadlines, you have projects, deliverables, milestones and the work pace is really fast.'*

This discrepancy in time commitment between Dawood and scientists is reflected in their responsibilities, and contribution to *Leviathan*, with Dawood as the sponsor, providing the majority of the efforts.

6. Funding

The funding of a collaboration is what Sargent and Waters (2004) considered in the 'resources' section of their framework. Therefore, this has already been addressed in section 4.1.

7. Support

In the case of *Leviathan*, support did not arise from ISMAR, but instead from Dawood's side of the collaboration in the form of: an exhibition curator, public programme curators, content editors, art direction and design team, project director, event coordinator, communications director, project managers, production managers, and exhibition producer, a philanthropic charity and a subscription video on demand service (Leviathan Cycle, 2017). Therefore, I propose to replace the term 'institutional support' with 'support' to make it more general and accommodating.

8. Respect

There is a nuanced distinction between trust and respect (Czajkowski, 2006) with varying effects on a collaboration. Mutual respect between collaborators of each other's discipline identities is essential in overcoming different, or even clashing, frames of references. As previously mentioned, the scientists of *Leviathan* favoured linearity whereas the artist's process was more iterative. However, through remaining open-minded, sensitive, and respectful of each other's methodologies, they were able to accept alternative cultural practices and meet somewhere in the middle:

S: *'What I found very fruitful during this collaboration is that staying very open you really were able to come together at some point, and giving quite a lot of understanding to each other and a lot of space. That was wonderful.'*

S: *'Being open is another very basic thing that you must do to communicate between different areas of interest.'*

S: "*Meeting Shezad was interesting as well because he is a very open-minded person."*

A: *'I think it's still, sort of, teasing people out of their habits and their fixed ways of doing things, myself included … I guess I'm always used to sort of opening myself to other people's processes. It's very much how I work and I think.'*

The importance of respect in overcoming potential conflicts in *Leviathan* illustrates its importance in a collaboration, warranting, I argue, explicit reference in a framework.

9. Amicability

Finally, I propose to replace the term 'attraction' in Sargent and Waters' (2004) framework with the word 'amicability', since attraction has connotations irrelevant to collaborative theory. Whilst perhaps not essential to a collaboration, mutual amicability between participants can be very beneficial in sustaining long-term collaborations, which, as previously discussed, was apparent throughout *Leviathan*.

5.2 PRESENTING A REVISED FRAMEWORK FOR UNDERSTANDING RESEARCH COLLABORATIONS

Taking all the above additions and refinements into consideration, I present a schematic diagram of a revised framework for understanding research collaborations, as shown in figure 9. The contextual factors are shown in blue, the interpersonal processes are shown in orange, and the phases of a collaboration are shown in green. The dashed line represents the process of a collaboration with agile feedback loops between each phase.

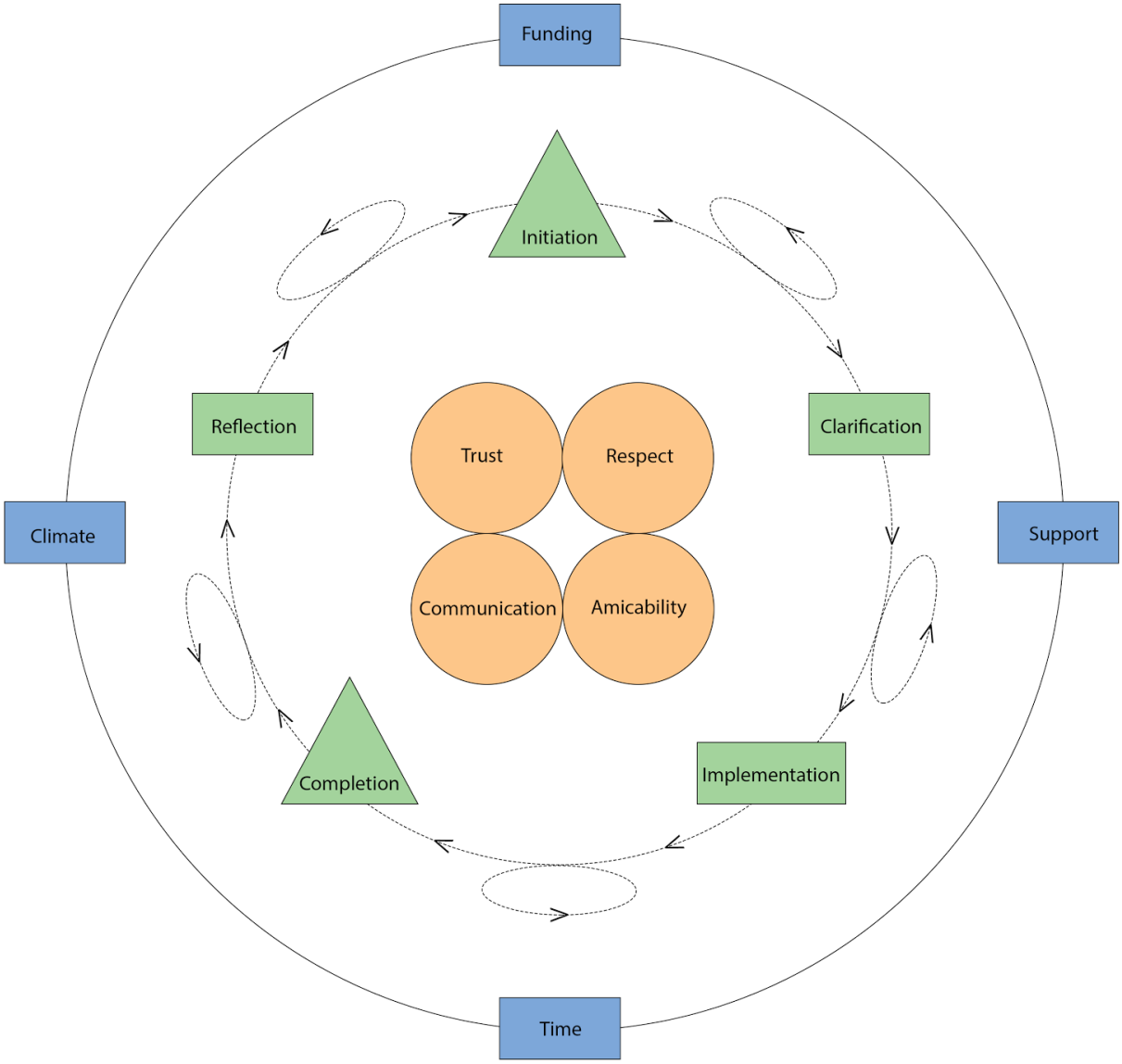

Figure 9: A revised framework for understanding research collaborations.

6.0 CONCLUSIONS

Embracing the flourishing discourse of contemporary art as a means of knowledge production, I have applied Sargent and Waters' (2004) framework for understanding research collaborations to the case study of *Leviathan*, an art-science collaboration between contemporary artist Shezad Dawood and ten scientists from the Institute of Marine Sciences. Consistent with previous collaborative research, strong interpersonal process yielded benefits integral to the success of the collaboration. In particular, trust and respect overcame contrasting sector methodologies, and amicability and effective communication between participants sustained infrequent contact, enabling the mutual satisfaction of collaborators' expectations.

The data synthesized through the application of Sargent and Waters' (2004) framework was rewarding to an extent. Noteworthy, recurring themes untended to by their framework became apparent through inductive coding and analysis. Taking these into account, combined with previous collaborative and psychological research, I presented a propositional framework with nine novel contributions, including an unprecedented adaptation of Maslow's hierarchy of needs, in an attempt to accommodate for these limitations. According to Sargent and Waters (2004) original framework as well as the novel framework, *Leviathan* was a successful collaboration.

The model developed in this study was intended to be a general guide presenting the salient success factors for research collaborations. However, it is important for each collaboration to recognise that there may be additional relevant factors that should be embedded into their specific framework depending on the context of the collaboration. The final products of a collaboration should also be evaluated according to criteria specific to the output type and collaboration context.

There is no doubt that there are unchartered territories in this underdeveloped field of inquiry that warrant further investigation beyond the scope of this study. The data used in this study was collected immediately after the collaboration terminated, however meaning often takes time to manifest (Ede, 2002) and so supplementary data could be collected sometime after the collaboration to see if anything new came to light. Action steps could be developed to assist participants in fulfilling the success factors at every stage of the collaboration. The novel framework could be applied to other collaboration case studies of varying nature to assess its robustness. A hierarchy could be devised to rank the importance of the different influencing factors on a collaboration, and perhaps a quantitative measure of the success of a collaboration could be developed.

Research collaborations are likely to continue to increase in the future (Katz & Martin, 1995), but their construction, development and maintenance must be guided by principles that create mutually beneficial and synergistic partnerships. By introducing nine novel contributions to Sargent and Waters' (2004) framework through the case study of *Leviathan*, this dissertation has attempted to expand the discourse of art and science collaborations, as well as collaborative research at large, with the intention of effectively supporting future research partnerships of all types in developing, maintaining and achieving successful collaborations.

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