A Comparison of Relational Practices in Additive Manufacturing Multipartner Alliances in France and the UK

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Résumé :

Les alliances multipartenaires (AMP, c'est-à-dire les alliances composées de plus de deux partenaires) dédiées à l'innovation se sont multipliées ces dernières années. Cette forme organisationnelle particulière pose de nombreuses questions, parmi lesquelles celle des interactions concrètes et des relations entre les partenaires. Afin de contribuer à combler ce que nous identifions comme un gap dans la littérature, ce papier – en cours de construction – s'intéresse aux pratiques relationnelles au sein des AMP. Nous soutenons que les cadres d'analyse des pratiques relationnelles dans les alliances dyadiques (Ness, 2009) ne sont pas adaptés au contexte des AMP et suggérons un cadre d'analyse plus complet. Ce cadre théorique a été construit par la revue d'une littérature variée et par l'étude comparative de deux cas, dans une démarche d'inférence. La littérature identifie les pratiques relationnelles en œuvre dans les relations dyadiques : elles sont *intégratives* (où la création de valeur prime) et *distributives* (où la captation de valeur prime). Notre travail suggère l'existence d'un troisième type de pratiques relationnelles, spécifiques au contexte des AMP. Nous les dénommons *pratiques relationnelles multipartenaires*. Elles consistent en trois mécanismes

de gouvernance : *Communauté*, *interprenariat*, et *sous-groupes* ; et une stratégie de négociation : *le consensus*. Nous étudions et comparons deux cas d'AMP dédiées à des stratégies nationales pour la fabrication additive (impression 3D) en France et au Royaume-Uni. Ces cas nous permettent de théoriser sur la base d'un contexte empirique d'actualité et sont appropriés pour la comparaison car ils ont lieux dans des contextes similaires. Nos observations montrent que les deux cas étudiés évoluent suivant différentes phases associées à des pratiques relationnelles. Durant une phase d'initiation, la création de l'AMP, les interactions reposent sur une gouvernance basées sur la communauté et l'interpreneriat, associée à une stratégie de négociation intégrative. Ensuite, durant la phase de déploiement, lorsque la réflexion stratégique se déroule, l'AMP est gouvernée par des mécanismes de sous-groupes et d'interpreneriat, et les négociations sont basées sur le consensus. Finalement, quand vient le temps de la mise en œuvre, la phase des résultats, les acteurs visent à mettent en œuvre une gouvernance basée sur les sous-groupes et le prix. Les observations communes entre les deux cas tendent à étayer le cadre théorique que nous proposons ici et à révéler des modèles d'évolution des pratiques relationnelles dans les AMP. Toutefois, la généralisation de nos résultats reste circonscrite à un type de contextes relativement limité. Le travail mériterait d'être étendu à d'autres études de cas. Nos résultats apportent néanmoins une contribution au comblement du gap que nous identifions concernant les pratiques relationnelles dans les AMP. Finalement, nos cas prennent place dans des contextes de politiques nationales d'innovation. Si cet angle d'analyse n'est pas celui que nous avons choisi, notre travail pourrait néanmoins apporter une contribution à la recherche sur le sujet.

Mots-clés : Alliances multipartenaires, pratiques relationnelles, écosystèmes d'innovation, mécanismes de gouvernance, stratégies de négociation.

1. INTRODUCTION

Additive Manufacturing (AM) technologies, also called 3D printing, are recognized as a strategic turning point for industry (D'Aveni 2015; Ford, Mortara, and Minshall 2016; see Gao et al. 2015 for a description in engineering). The US, China, Germany, the UK and France have developed, among other countries, national strategies for competitiveness in the development of these technologies. If AM is proved to be a game changer, the success of these initiatives should be crucial in the international economic competition. These large inter-organisational cooperative arrangements dedicated to innovation at a national level become more and more significant (Meissner 2015; Etzkowitz and Leydesdorff 2000; Provan, Fish, and Sydow 2007) and raise several issues. Much remains to be understood about the way they operate and this understanding could be a key to future economic competition.

In France and the UK, these strategies rely on collaboration between different types of organisations. These organisational settings echo the growing literature on the different types of collaborative innovation that have become more and more common during the last decades. These arrangements have led to research on alliances (Mitchell and Singh 1992, Doz and Hamel 1998, Osborn and Hagedoorn 1997, Kale and Singh, 2009), networks (Powell, Koput, and Smith-Doerr 1996; Perks and Jeffery 2006; Gibbert and Durand, 2007), technology partnerships (Duysters, Kok, and Vaandrager 1999) or R&D consortia (Katz 1986; Sakakibara 2002). They are broadly recognised as enabling innovation and adaptation to technological change (Sakakibara and Cho 2002; de Vaan 2014).

Literature on multi partner alliances (MPA) defined as "*inter-organizational cooperative arrangement between three or more partners built for a common purpose*" (Albers, Schweiger, and Gibb 2015) provides insights into management of these cooperative arrangements. The different governance structure of these arrangements have been studied (Provan and Kenis 2007; Provan, Fish, and Sydow 2007; Li et al. 2012), and the role of the central firm or group has been emphasised in particular (Dhanaraj and Parkhe 2006; Reuer and Devarakonda 2016). Equally, some specific management activities that these arrangements require have been reported upon (Saz-Carranza and Ospina 2011; Gustafsson and Jarvenpaa 2017). Researchers have recently suggested integrative perspectives on these collaborative initiatives. For example, Gustafsson and Jarvenpaa (2017) suggested a community management perspective on Triple Helix organisations. An inclusive framework

on collaborative initiative has also been suggested from a public sector perspective (Bryson, Crosby, and Stone 2015). However, beyond such research on governance and management of MPA, the practical interaction and relation between members is still to be studied if we want to understand how to manage MPA. In a nutshell, our aim is to contribute to fill this gap of relational practice within MPA. Our research question is hence: *How do actors relate and interact in a MPA context?*

To suggest theoretical insights into this question, this paper starts with a framework developed by Ness (2009) about relational practices in alliances defined as "t*he interaction pattern 'agents typically use for coordinating activities and relation'"* (Windeler and Sydow, 2001 cited by Ness, 2009, 452). It then unites pieces of other research to complement the framework for the context of MPA. Following this, we present the a comparison of two cases studies based on this framework. As we are investigating a "how" question, the case study approach was the relevant methodology (Yin, 2014). We studied the cases of the French and the British strategies for AM to provide answers to our research question. These cases provide relevant manifestations of the MPA phenomenon and are thus appropriate to support our theoretical proposition. If contextual elements inevitably influence the MPA we study, they also bring a special relevance to our cases.

The main finding of our research is the theoretical framework we suggest, derived from theory and data. Beside integrative and distributive relational practices typically used for dyadic alliances, we describe a Multipartner Relational Practice with modes of interaction specifically appropriate for the MPA context. More precisely we show how, in a first and second phase, actors interact through Integrative and Multipartner relational practices. Relationships rely notably on problem solving and consensus-based negotiation, and on the two pairs of governance mechanisms: interpreneurship-authority and trust-community. We then illustrate how, in a third phase, the evolution towards an acquisition of financial resources by the MPA and a price-based governance is difficult. Moreover, we also illustrate how community is a relational practice as well as a strategic aim of observed MPA, blurring the line between strategy process and strategy content.

This research contribute to advance our understanding of how multipartners alliances operate, specifically regarding the interactions between actors within MPA. Focusing on the relational aspect of these arrangements, we offer a complementary perspective compared to the framework based on community management (Gustafsson and Jarvenpaa 2017). More

broadly contribute to a systemic understanding of MPA initiatives (Provan, Fish, and Sydow 2007; Bryson, Crosby, and Stone 2015; Albers, Schweiger, and Gibb 2015) by – following Ness (2009) – developing a relational practices approach on MPA. We also offer a complementary perspective compared to this last research, by complementing relational practice perspective in the MPA context which follows Ness's remark about specificity that multiple organisations collaborative context might have on relational practices, and the research gap on this issue (Ness, 2009, pp. 478). Also, as these groups of organisations collaborating at a national level to innovate are embedded in public policies. They thus relate to the literature on national systems of innovation (Lundvall, 1992, Nelson, 1993, Freeman 1995, Mowery 2011). Involving academics, firms and the public sector, they could be described as having Triple Helix Model (Etzkowitz and Leydesdorff 1995, Etzkowitz and Leydesdorff 2000). This aspect is probably a blind spot of this research. In other words, if our work may provide insight into this research field, analysing our cases through (or even using our framework) this lens could be a future avenue of research. Among other limitations of this research, the intrinsically limited generalizability and the need for other case studies to reinforce our framework must be noted.

The next section of our paper details the building blocks of our theoretical framework. Afterward, we explain our research methodology. In the fourth part, in the fourth part, we present the findings of the comparative case study. Finally, we discuss the implications of our results and conclude.

2. CONCEPTUAL FRAMEWORK

2.1. MULTIPARTNER ALLIANCES

As it is largely identified in the literature on alliance, interfirm cooperative relationship also include a share of competition (e.g. Hamel 1991). This mix of cooperation and competition can be understand as a tension between self-interest and shared interest in the alliances (T. K. Das and Teng 2000). This tension takes a more complex form in MPA and thus requires a specific management approach (Das and Teng 2002; Zeng and Chen 2003). The framework of multilevel embeddedness suggested by Gudmundsson, Lechner, and van Kranenburg (2012) advocate for the idea that the balance between self and collective interest imply complex and rich interaction mechanisms.

In recent years, there has been an increasing amount of literature on collaboration between multiple actors) (Albers, Schweiger, and Gibb 2015; Das and Teng 2002; Provan, Fish, and

Sydow 2007; Perks and Jeffery 2006; Bryson, Crosby, and Stone 2015; Davis 2016; Fjeldstad et al. 2012). If this literature employs different terms to define this inter-organisational cooperation (e.g. network or constellation) (Albers, Schweiger, and Gibb 2015), we use the comprehensive term of multipartner alliance (MPA). Research identifies some features of these organisational arrangements that have an impact on their management and the way they operate.

In their literature review, Albers, Schweiger, and Gibb (2015) sum up these specific features of MPAs. The "complexity effect" is caused by the number and the variety of partners and, hence, the number of different relationship between these partners. Das and Teng (2002) highlight that this complexity constitutes a context of generalised exchange (i.e. reciprocity doesn't take place between two actors but is indirect) requiring a specific system of exchange (Das and Teng 2002; Fjeldstad et al. 2012; Lerner and Tirole 2005). The "power allocation effect" reflects the diversity of potential power distribution and their sources stemming from the diversity of possible MPA configurations (Albers, Schweiger, and Gibb 2015). Studies on power allocation have also considered governance of these arrangements (Provan, Fish, and Sydow 2007). Finally, the "timing effect" describe how partners may entry and exit the MPA in a rapid continuous way. This aspect increase the fuzziness of MPAs and must be managed (Albers, Schweiger, and Gibb 2015).

2.2. RELATIONAL VIEW OF ALLIANCES

Emphasising the idea that alliances are evolving agreement and are thus places for negotiation, Ness (2009) suggests integrating negotiation strategies in the understanding of alliance governance in what he terms relational practices. Drawing on broadly recognised theoretical development regarding governance and negotiation, Ness (2009) suggest a framework to understand relational practice.

Three governance mechanisms are identified. The first is price (i.e. the economic or market based structure of a relationship), the second is authority (i.e. the hierarchical features of the governance – explicit or implicit as legitimate traditional authority), and the third is trust (i.e. including parties trust that the other will not try to exploit their vulnerabilities, trust in terms of competence trust, and share common norms).

Ness also identifies two main types of negotiation. He explains that "*integrative strategies contribute to value creation and goal realisation of alliance, while distributive strategies are linked to realisation of private goal and value claiming*" (2009, p.455). Drawing on these

elements, the author suggests two relational practices: the combination of a problem solving negotiation strategy with a trust and authority-based governance contributes to the integrative relational practice; the combination of contending negotiation strategy with price contributes to a distributive relational practice.

Ness (2009) identifies relational practice in contexts of dyadic relationships, and the specific features of MPA are likely to imply the need for other relational practices. For example, the complexity of exchange would have an impact upon negotiations which will take place in an MPA context. Moreover, the difficulty of power allocation will probably have consequences on possible hierarchical governance. Hence, taking this specific context into account, we build upon existing literature on MPAs to suggest a completed theoretical framework of relational practice in MPAs.

2.3. MULTIPARTNERS RELATIONAL PRACTICE

We gather under the concept of Multipartners relational practice the governance and negotiation patterns specifically suitable for the MPA context.

Due to the features of the MPA, a fine grained management of its sometimes messy action is difficult. Thus, the alignment of partners toward a common goal and its pursuit, require a shared culture that has been described as a common cooperative macroculture (Das and Teng 2002) or a social system of shared rules and norms (Sydow and Windeler 1998; Uzzi 1997). We name *community* the governance mechanism through which the structuration of actions within the MPA are based on a largely shared culture, values, norms and topics of interest. Community is notably reached through recognition of a common situation and stakes, openness that allows for plurality, socialisation (Gustafsson and Jarvenpaa 2017) or fostered communication between members (Saz-Carranza and Ospina 2011; Zeng and Chen 2003).

Moreover, MPAs' features make the usual market and hierarchy drivers insufficient. Hence, collective action in a MPA may need a particular impetus. In this loosely managed organisational setting, this impetus may be given by entrepreneurs of interfirm cooperation. We name *Interpreneurship* the action of an individual creating, developing, and animating the MPA. To the best of our knowledge, the idea of interpreneurship has seldom been used in management literature. Exceptions focus on the networking aspect of entrepreneurship (Richter and Teramoto 1995), the attempt to elaborate on external influence of intrapreneurship (Antoncic 2001), and a focus on the intergenerational renewal of family

business (Poza 1988; Hoy 2007). Finally, interpreneurship has been seen as having an impact upon the process of institutional change driven by networking coalitions (Miller 1987).

Organisations involved in MPA have different ties with each other. Specific close relationships and common activities between some members of MPA lead to the existence of sub-groups, sometimes called cliques or clusters (Provan, Fish, and Sydow 2007, see for an example Gustafsson and Jarvenpaa, 2017). Sub-groups providing particular services can, in some cases, lead to greater efficiency of the overall MPA (Provan and Sebastian 1998). Moreover, Davis (2016) recently illustrated the importance of sub-relations in triadic alliances. We define *sub-group* as the governance mechanism through which achievement of some activities is conducted by specific groups of members of the MPA.

As partners' self-interests and their points of view may significantly vary in MPAs, the decision process should entail large scale discussion to encompass the different positions of partners. Management of these incongruous positions can be achieved through the representation of partners in decision making (Gustafsson and Jarvenpaa 2017). Addressing this need has also be understood as a 'framing work' (Saz-Carranza and Ospina 2011), which consists of extensively taking account of different positions to create shared objectives based on common interests. We call *consensus reaching* the negotiation strategy which consists of in making a decision which is accepted by all the partners.

These governance mechanisms and negotiation strategies form a multipartner relational practice which aims to set and achieve the goals of numerous partners. Table 1 below summarises our analytical framework.

Table 1: Relational Practice in MPA

	Integrative	Multipartner	Distributive
Governancee	**Trust** Parties trust that other will not try to exploit their vulnerabilities, trust in terms of competence, common norms **Authority** The hierarchical features of the governance – explicit or implicit as legitimate traditional authority	**Community** Structuration of actions within the MPA based on largely shared culture, values, norms and topics of interest. **Interpreneurship** Action of an individual creating, developing, and animating the MPA **Sub-groups** Achievement of some activities is conducted by specific groups of members of the MPA	**Price** The economic or market based structure of relationship
Negotiation strategies	**Integrative (problem solving, inaction)** Contribute to value creation and goal realization of alliance	**Consensus reaching** Making a decision which is accepted by all the partners.	**Distributive (contending and concession making)** Linked to realization of private goal and value claiming

3. METHODOLOGY

In this paper, we intend to observe and theorize about relational practices in multipartner alliances. The literature approaching this question provides fragmentary answers but remains unorganized. Consequently, our intent is to refine and collate such theoretical pieces, and to draw on empirical observation to elaborate on this framework and provide theoretical insights about our research question.

Due to the complexity of the phenomenon we study, we decided to compare two qualitative longitudinal case studies. This method was selected as it allows in depth exploration that grasps relational practice in action during contemporary events (Eisenhardt 1989; Eisenhardt and Graebner 2007, Yin 2014). Yet our reasoning is not purely inductive as we have also built from pieces of existing research. Indeed we iterated between theory and data and refined our analysis, based on the constant comparison between our growing dataset and the theoretical framework we were continually narrowing (Corbin and Strauss 1990, Suddaby 2006). From an epistemological standpoint, we thought abductively.

We studied and compared two cases. The first was the development of the *UK AM national strategy* and the second, in France, the *AM initiative of the Alliance for the Industry of the Future*. The two cases are MPA created at a national level to develop a strategy for AM. They both verify the complexity, power allocation and timing effect mentioned in the literature.

They are thus relevant to our question. Moreover, both cases take place in very close contexts, involving the same technologies, the same types of actors, and have comparable national contexts regarding political systems, economic power, development level, and country size. Hence, using these cases allows us to approach replicability in our study. If complete replicability cannot be achieved in qualitative studies where settings are intrinsically unique, our cases are close enough to be compared without too much contextual noise. Some contextual elements must also be noted. First, AM is a radical innovation, sometimes envisioned as the trigger of an 'industrial revolution'. Our research is thus embedded in the context of radical innovation. Moreover, both the MPA we study are embedded in a national policy agenda. More broadly, awareness of the potential of AM has raised and has led to a worldwide intense competition at a country level. Taking in account these context specificities, we could name more accurately the phenomenon we study by using the term of national technology MPA. This creates the limits of the theoretical generalizability of our findings. However, radical innovations are a field of fierce economic competition which is particularly relevant for strategy research. Also the "National System of Innovation" aspect of our case means that this specific context provides another good theoretical reason to be studied.

The process of data collection was slightly different for the two cases: it involved participant observation in the UK versus a mix of participant and non-participant observation in France. In France, 23 formal interviews (21 recorded and transcribed, 2 with note taking), lasting between 30 minutes and two hours, were held between December 2016 and September 2017. These interviews were mainly conducted with central members of the MPA, and some 'simple participants' were also interviewed. We also had a regular exchange with a main informant, who can be considered as the head of the initiative, to keep us updated with the evolution of the initiative. Moreover more than 30 sets of presentation material used in meetings, and some working documents as well as public information were used as secondary sources of data. Finally, we took part in three plenary meetings and five working group meetings, where we had the occasion to discuss informally with participants who knew we were observing the case for research purposes. In the UK, primary data were essentially captured in participant observation by some of the authors who were also members of the strategy's Steering Group. As such, they took part in more than 50 meetings and regularly exchanged with the working group. They also undertook much of the data gathering and

analysis that was used to underpin the formulation of the strategy documents. Secondary sources of evidence were also used: these included published reports, presentations and articles relating to AM development and adoption. Based on the collected data, we wrote up detailed story lines of both cases and used them as the basis for the analysis. At the time of submitting this version of the paper, actors from the field were mobilized to verify the details and accuracy of cases narratives, following a member check procedure (Lincoln and Guba, 1985). Short versions of these cases are presented in the next section. Following Das and Teng's (2002) view of alliance evolution, we present the alliances evolving in three phases: initiation, operation, and outcomes. These schematic phases structure the narrative of the case but tend to simplify a complex reality where activities' boundaries are blurred.

4. FINDINGS

4.1. UK ADDITIVE MANUFACTURING NATIONAL STRATEGY CASE STUDY

4.1.1. Initiation (early 2014 – early 2015)

In 2014, following the publication of a series of reports by various industrial and policy groups, the idea of developing a strategy for the UK to profit from additive manufacturing appears. It was not initiated directly by the UK government but emerged during a meeting of academics and industrialists in April 2014. This led to the formation of a Steering Group that brought together civil servants, industry and academia representative to explore the scope and process of developing a national AM strategy for the UK. An initial activity of this group was the writing of a 'positioning paper' for AM. This paper presented the broad challenges facing AM, three scenarios for intervention, and emphasised the need for "[...] *a government supported UK Strategy for (...) AM*".

At that time, representatives of public institutions made clear that the intent was not to produce a government strategy for AM, but rather for this Steering Group to coordinate the development of an industry-led strategy for the UK with the Government's support. In order to clearly signal this intent, leading figures from UK manufacturing industry wrote a joint letter to the then Minister of State for Skills and Enterprise. To signal this 'industry-led' approach, it was decided that the steering group would be headed by an industrialist. On its side, the government declared recommendations would be 'welcomed'.

THE Steering Group recognised the need for input from a wider range of sources representing the views of UK organisations all along the technology value chain. The Steering Group also recognised the importance of signalling that the strategy development process was to be as

open as possible, with the strong engagement of private and public stakeholders. The decision was made to gather evidence from a series of multi-organisation workshops and an on-line open call for input.

4.1.2. Operations (early 2015 - October 2016)

A common process was used at all three events. Attendee's perceptions were synthesized through a roadmapping methodology. All attendees were then given a chance to review a full set of the maps, and to provide comments on any arising issues. In addition, throughout the process, members of the Steering Group were sent sources of secondary data that were reviewed and catalogued. All sources were reviewed to identify common themes and their frequency of appearance in the primary and secondary data. Contributors to the workshops and the on-line call for evidence were also asked to consider the main opportunities for AM in the UK.

During this period the steering group agreed that increased industrial representation was important and invited two additional industrialists onto the steering committee. It also became clear that the involvement of the High Value Manufacturing Catapult (the UK collective R&D centres created by the government) would be critical to align the developing strategy with existing manufacturing-related support activities. To address this concern the Director of Operations at High Value Manufacturing Catapult was invited to join the Steering Group.

To develop the content of the strategy, seven thematic working groups were formed. They were mandated to further investigate the main issues identified in the initial round of data collection. Members of the Thematic Working Groups were drawn from a broad range of organisations within the UK AM community: companies (manufacturing, banking, legal services, design services…), government departments, government agencies, universities, and consultancies. Some of these members were invited and some had volunteered. Each Working Group was given the freedom to address the task as they saw fit, and used a variety of mechanisms. The Steering Group brought the Working Group chairs together from time to time to encourage cross-fertilisation of approaches and results. Through this process, the Working Groups provided a key input to the development of strategy and the implementation plan.

Moreover, to keep collecting data and to help connect community, the steering group decided to establish a single-point-of-contact. This led to protracted discussions regarding conflicts of

interest, the need to maintain neutrality, and avoidance of any preferential promotion of services. The Steering Group decided that the UK National Centre for Additive Manufacturing (based at the Manufacturing Technology Centre, part of the High Value Manufacturing Catapult.) should organise and manage a website of key relevant events, resources, and people under the banner of 'Additive Manufacturing UK'. The lack of other options was key in this choice.

For the purpose of gathering together the UK AM community again, two other actions were initiated. First, a proposal was submitted to InnovateUK's Knowledge Transfer Network (KTN) programme to set up an Additive Manufacturing Special Interest Group. This was approved and launched in 2016. Second, the Steering Group discussed at length the possible need for a trade association for UK AM companies. The Steering Group was approached by, or made aware of, existing trade associations whose management believed that their association or network already represented the UK AM community. The complexities revealed by these interactions led to the Steering Group deciding that the case for the establishment of a new AM-specific trade association was not sufficiently compelling at that time.

In June 2016, the Steering Group began to draft a strategy document that summarised the outputs of the previous data collection and reflection. However, the result of the 2016 Brexit referendum and the development of a UK Industrial Strategy presented the Steering Group with a dilemma: on the one hand, the uncertainty caused by the Brexit decision pointed to a need to delay publication of the strategy; on the other, the announcement of the intent to develop a UK Industrial Strategy pointed to the need for a clear strategy for AM that could explicitly feed-in to the Industrial Strategy. Following debate, the compromise decision was made to release an interim document, called a – *platform document* – which would provide an update on progress, present the emerging recommendations, but also highlight the need for further refinement and targeting of implementation activities, and thus postpone the publication of the actual strategy document. This document was published in September 2016 at a public event for the AM community in order to avoid the risk of disengagement of these volunteers that could result from the decision to delay publication of the final strategy. The decision to publish the final strategy document in 2017 was also announced at this time.

4.1.3. Outcomes (October 2016 – December 2017)

Following the publication of the Platform for Engagement document, the Steering Group met to review its approach within the changing economic and policy context. Sub-groups of the Steering Group took on the responsibility of engaging with the Working Groups to discuss connections and overlaps between their respective works, and with various UK industry leadership councils to focus on sector specific issues.

Also, as anticipated, the government announced in its autumn economic statement the formation of a 'Challenge Fund' (which became known as the Industrial Strategy Challenge Fund (ISCF)). It was designed to fund industry-research collaborations aimed at addressing specific industrial challenges related to a range of technologies. The steering group targeted some efforts on preparing a bid for the Industrial Strategy Challenge Fund (including a synthesis of identified challenges and of activities requiring funding and a governance structure to allocate resources). An outline bid was submitted in May 2017. Over the summer of 2017, a series of 'Challenge Workshops' and 'Deep Dives' to identify and quantify the most compelling areas for ISCF support were conducted by the UK government. One result of these activities was, after some discussion, the merging of the AM ISCF bid with a separate bid which had been submitted on the topic of industrial digitalisation. This merged bid was not successful in obtaining funding in this round of the ISCF programme. However, if the MPA was not funded here, some of the participants were involved in other research projects, partially funded by European Union since 2013.

By the end of 2016, there was a clear view from the Steering Group that a final version of the strategy document should be released as soon as possible. The group believed that a failure to do so could result in a loss of credibility and goodwill among the AM community that had been fostered over this three-year period. The task of drafting the final version of the UK AM National Strategy was taken on by a sub-group of the Steering Group in January 2017. This sub-group drew upon all the evidence captured to date, and the process of analysis and synthesis undergone to produce the Platform for Engagement document and the ISCF bid document. The strategy was revised many times before being finished and then published in September 2017.

4.2. FRENCH CASE

4.2.1. Initiation (June 2014 – March 2016)

In June 2014, the French Ministry of the Economy launched an industrial policy program named *The 33 plans for the new industrial France*. The program aimed at reviving French industry by supporting the implementation of digital technologies. A few months later, a 34th plan was created. It was first named *Factory of the Future* before the focus broadened and led to the program being renamed *Industry of the Future*. The government wanted to include industry representatives in the process of reflection and assigned its development to the heads of two industrial companies. A range of actors, drawn from among professional federations, industrialists, research labs and academics were also intended to play a role in this reflection. This is how the *Alliance for the industry of the Future* (hereafter the *alliance)* was envisioned and then created in July 2015. At the beginning, 11 founding members took part, though this number increased to reach 34 members in June 2017. The alliance is a non-profit association, supported although not controlled by the government, mainly funded by membership fees, and topped up by a public grant, it has 3.5 full time equivalent employees. Among technological priorities, AM was identified as a very important priority, and this idea was shared by public and private actors, even since before the creation of the alliance.

During the second half of 2015, several driving forces converged toward the creation of an AM focused initiative (hereafter the *initiative*). In September 2015, a report on AM in France was submitted to the prime minister. This report highlighted the potential of the French industry in AM, the need for coordination, and led the author to identify and get in contact with many actors involved in AM in France. The government informed him of the convergence between the report's conclusion and the alliance's beginning actions. Meanwhile, preliminary discussions started between industrialists, research centres, professional federations and academics; among which were some members of the alliance. Observing events such as General Electric's acquisitions in AM or the developing national programs for AM in industrial countries, many actors involved in AM understood that this competitive context required to coordinate efforts and share actions, notably at the national level. In the same period, three important collaborative R&D projects, financially supported by government agencies, were launched by three industrial companies of the CAC40 which were involved in the initiative. One of these companies was also already working on another

future collaborative R&D platform. Among other projects, a research centre was appointed by a French government agency to build a cartography to show where the AM research skills were present in France. This cartography later included inputs from the members of the nascent AM focused *initiative*. In this context, a preliminary meeting, gathering 50 people from 12 organisations took place the 7th January 2016. This meeting produced a first working draft (based on a version 0) and was the starting point of the initiative.

During this formative stage, the question to make this initiative free, open, and inclusive was raised. This openness principle was different from the Alliance membership regime that implies the payment of a subscription, and indeed openness was seen by some actors as opposed to their interests. After some debate, the decision was finally made to make the initiative open. From the early development of the initiative, an informal steering group was formed by the director of the alliance (employee of the alliance), the appointee for the alliance's program *developing the Future Technology Offer* from which the initiative was created *(employee of a research centre member of the Alliance)* and three other participants: two industrialists already involved in pre-existing collaborative research projects and one research centre conducing the pre-existing cartography project. The governance of the initiative is hence informal rather than explicit, as was the decision process on the leading role played by participants. Leading positions informally falls on some participants as they became essential in the process through their engagement and action. In other words, the choice of governance, through the formation of this informal steering group, was an informal emerging process. Other participants were involved in a 'facilitating transversal group' of 13 people, and they were also members of the pre-existing community.

4.2.2. Operations (March 2016 – December 2016)

The 15th March 2016 a kick-off meeting officially launch "*The Additive Manufacturing Initiative: building together a strong French economic ecosystem.*" This one day meeting was dedicated to explain the purpose and planned operations of the initiative, to present existing projects on AM, and to give the floor to participants to start to collect opinions and points of view. To avoid competitive issues the steering group decided that the focus of the work would be explicitly on the precompetitive field. These first discussions allowed for the identification of 10 themes around which 10 working groups were to be built. Between mid-March and June 2016, participants in the initiative (up to 145 people registered to take part in the process) were divided into 10 thematic working groups. These working groups organised meetings

during this period which produced 80 "draft action sheets". Then, members of the facilitating transversal group classified the 80 "draft action sheets" in seven transverse axes in a process of "*convergence*". A synthesis of the results of this phase was presented in a third open meeting of the initiative on 24 June 2016 attended by 120 people.

After this meeting, the next phase was intended to be a maturation process, which would lead from the 80 "action fiches" to "concrete action fiches" which could be easily used as a basis for action by the public authorities. In the end, this maturation consisted of a meeting of the 'facilitating transversal group' where fiches were prioritized using a classifying matrix based on importance and accessibility of actions. This synthesis led to the writing of the first roadmap issued in late November 2016 during an open meeting where other projects in progress (R&D projects, industry studies…) were also presented. The positive and consensual reception of the roadmap by the participants shows that the roadmap was representative, at least to a certain extent. At the end of August 2016, before the presentation of the roadmap, there was a new French Minister of the Economy. Hence, the presentation of the roadmap to the minister was postponed. At this point, if the document was officially a "roadmap", members of the steering group considered it more as a "master plan" to insist on the fact that the document framed, and made sense for, collective action but still remains flexible and in a process of development.

4.2.3. Outcomes (December 2016 – September 2017)

On 1 December 2017, the French President announced that he would not run for a second mandate in the next elections, scheduled for May 2017. This slowed down the work of the government and ministerial offices. If it did not stop all activities, it led to postpone some discussions with the government and some participants saw the electoral period as a break in the initiative action.

During the first months of 2017, members of the Alliance presented the roadmap to the government agency for business to discuss what could be done, and by who. In March 2017 the government gave a communication about actions and projects led by important members of the initiative. Some of these projects had been in progress since before the beginning of the initiative (e.g. collaborative research projects, as mentioned in the initiation phase) and they were not implemented by the initiative itself but rather by some participants in the initiative, collaborating with other organisations. In this communication, the roadmap was the only outcome from the initiative itself.

The next public meeting took place in June 2017, and it was the occasion to give feedback on the action of the initiative, to present the content of the roadmap, different projects and regional R&D platforms. During this meeting, a call was made for "Industrial Crowdfunding", which received a cautious reaction from some industrialists who awaited the announcement of public financial support. Indeed, as the time has come for implementation of elements of the roadmap, financing actions have become key. However, rules of funding by the government are directed toward projects (by industrialists, academics, semi-public research centres…) and the intermediation of an association such as the alliance that would then allocate resources was thus difficult. Public funding for the initiative, which was open and has no formal governance or boundaries, would have been impossible. On the other side, companies didn't want to fund the MPA either. Instead, their intent was to secure a public funding for a project in which they planned to invest.

The second half of 2017 was mostly an idle time for the initiative. A new R&D platform was launched in early December 2017. It grouped 18 founding organisations among which were four members of the initiative steering group (all of them except the director of the alliance which was not a founding organisation), and, at least, six participants in the initiative. The platform has a budget of 40 million in 5 years, partly funded by the Ile de France regional council (i.e. not at the national level). The project was already envisioned by one of the industrial companies represented in the steering group, which presented its vision during the kick-off meeting of the initiative.

4.3. COMPARATIVE ANALYSIS

This part present the cases comparative analysis, it is summarized in the table 2.

4.3.1. Community

The collective raising of awareness in both countries led to the emergence of communities of people willing to cooperate to gain competitive advantage based on the new technology. This governance of the creation of the MPA through a community linked by a common topic of interest is important in the initiation phase.

This community based governance is also important in the operation phase to gather people in order to collect points of view and opinion useful to gain understanding of the needs of the nascent industrial ecosystem. Both in France and the UK, the strategizing process went through a data collection phase based on large open meetings. Gathering people at these

events requires community governance, as the only reasons for attendance are the interest in the technology and the belief in the relevance of a national level initiative.

Moreover, the question of boundaries has been raised in both MPA, and both decided to be open to everyone interested. This openness principle is a central aspect of community, it allows for multiplication of the points of view and the development of a more accurate view of national industry's needs. These insights are essential for governments whose mission is to work for the national interest.

4.3.2. Interpreneurship

Interpreneurship played a key role during the initiation of both MPA. Whether the government provided the impetus (as in France) or the MPA emerged from a 'private' initiative, individual initiatives really allowed for establishing the existence of the MPAs. Members of the first steering group in the UK, who wrote an initial letter to the Prime Minister, or those involved in the first exchanges and preliminary discussions in France, or the actors from different organisations who invite interested people to a first meeting make the MPA possible at the beginning. Then, interpreneurship also was a very central governance mechanism as groups steering the MPA relied on the initiative, energy and time that their members give to the MPA despite the absence of dedicated resources and corporate objectives behind them. As there is no strong hierarchy or market mechanisms to steer the initiation and operation phases, actors that act as facilitators of interfirm cooperation are needed and legitimate.

4.3.3. Sub-groups

During the operation phase, governance by sub-groups was well established in both MPA. For the data collection step of the strategizing process, topic-related working groups were created in both MPA. Then, after this data collection stage, sub-group governance mechanism was also in use for other specific tasks. The UK case illustrates where a sub-group of the steering group notably engaged with the working groups. Also, the collective strategizing process required at some point a synthesis of the inputs of participants and the production of an outcome document (a strategy, a roadmap). These phases represent an important amount of work which was governed through a sub-group mechanism (with a certain amount of consensus reaching as we will see later).

Otherwise, we observe a difference in how sub-group governance is implemented. In France, groups of organisations implement projects linked to AM, such as R&D projects or advisory

missions for SMEs interested in AM. These projects are parts of an emergent strategy as some of them started before the release of the roadmap (Mintzberg and Waters 1985). They are consistent with the strategic options chosen and are presented during meetings of the initiative. Also, they are undertaken by participants of the initiative, and in a large part by members of the steering group. The Initiative and more broadly the alliance and MPA acted here as facilitators, social clubs, and endowed sub-groups with legitimacy. However, the projects remain loosely coupled as they are financially and organisationally fully independent from the alliance. Implementation of the strategy (with a certain amount of emergence), is, hence realised through a sub-group governance mechanism. We didn't observe this mechanism in the UK.

4.3.4. Consensus reaching

The craft of reaching consensus is central in MPA, as collective making decision accepted by every partner is essential to maintain engagement of actors and links between them. Indeed, as we emphasized, MPA are open to many companies with possibly divergent interests. Hence to achieve a common strategic proposition, making a decision which is accepted by all is essential. In both cases, the data collection phase was as open and inclusive as possible, leading to rich exchanges with participants to take into account as many issues as possible. The write up of the strategy also aimed to include all the evidence captured. Both these elements illustrate the importance of consensus reaching in the strategizing activities of an MPA.

4.3.5. Distributive relational practice

Governance through Price (an element of the distributive relational practice) requires some comments. None of the MPA were funded at the beginning. If the French Alliance has some resources for its regular operation, the MPAs (i.e. the initiative) does not. The MPAs thus operated without a monetary mechanism. Thus, governance mechanisms from multipartner and integrative relational practice were used. At some point, when the time came to implement the strategy, financing become necessary. Here, the structure of observed MPA represent an issue, notably due to institutional reasons. In France, financing the MPA was revealed to be institutionally difficult, as shown in the outcome phase of the French case description. As a consequence, funding and price based governance came with sub-groups governance mechanism as illustrated by the R&D project launched in December 2018. In the UK, it was envisioned to directly finance the MPA when bidding for the ISCF. However the

MPA was not awarded funding, and hence did not evolve to a price based relational practice. If the MPA was not funded here, many participants were involved in other AM related research projects, partially funded by public sector.

4.3.6. Integrative relational practice

Integrative relational practice was important in both the MPA. At a general level we observed in our cases the general adoption of a problem solving negotiation strategy with multipartner relational practice. Indeed, the value created by the MPAs is indirect and distant. As we mentioned, there was no funding nor price based governance. In this situation, adopting a distributive negotiation strategy would have been irrelevant and premature. An indirect distributive negotiation strategy existed to the extent that participants may have kept their organisation's self interest in mind when pursuing the collective aims.

Hence a problem solving logic seems to be the major one that can guide the participant under the "complexity effect" within the MPA operations. It is for example shown by the openness of both initiatives and in the choice of a neutral as a single point of contact in the UK.

At a more precise level, we identify two couples of governance mechanisms in which multipartner governance mechanisms go hand in hand with integrative ones. The first couple is composed of community and trust governance mechanisms. The large number of participants in an MPA make difficult the direct exchange between members. This situation require a certain degree of community between members, this community is linked to a generic trust that integration in the community will create value and not be wasted time or lead to opportunism by other members. Moreover, participants must trust that the competence of the community will lead the common action to succeed. Hence, building a community as a governance mechanism seems impossible without a certain amount of generalised trust. We thus claim that these two mechanisms go together in the context of an MPA. The second couple is composed of interpreneurship and the authority governance mechanism. For example, the steering groups were composed of interpreneurs who occupy the position because of what they bring to the MPA. In the context of the power allocation effect described in the introduction, there is no simple and explicit power structure in MPA. Hence, the hierarchical authority that exists rely on this interpreneurship which is its source of legitimacy. The two governance mechanisms goes together.

Table 2 Comparative analysis summary

	France	UK
Initiation	• Government as a principal	• Government is supportive
	• Strong impetus from some **interpreneurs**	• Idem
	• Open **Community** to gather people around a common topic of interest	• Idem
Operation	• Strategizing through **sub-group**	• Idem
	• **Consensus** reaching methods used in strategizing	• Idem
	• Strategic synthesis and other actions through **interpreneurs** and **authority**	• Idem
Outcomes	• Missed evolution of the MPA toward **price**. However**,** funded initiatives exist through **sub-group**	• idem

4.3.7. Role of government

In the initiation phases the support of the government is important. However, in France, the first move came from the government (or at least private and public wills met) whereas in the UK the first move clearly come from non-government actors, who then gained the support of the government. In both the situations the government was in a position to receive recommendations from industry experts, in order to help him to implement its policy. If government is rather supportive of industry, we also see that the political context may hinder the development of a national technology strategy. This is illustrated in both cases by a slowdown of the work of the initiatives due to political reasons.

5. CONCLUSION

In this paper, we drew on a literature review and two case studies to understand how do actors relate and interact in an MPA context. The first contribution of this research is the framework we suggest to answer this question. We provide pieces of evidence that specific governance mechanisms and negotiation strategies take place in multiparner alliances context. These types of interactions form a relational practice we name multipartner relational practice. It is composed of community, interpreneurship and sub-group governance mechanisms and of a consensus reaching negotiation strategy. Multipartner relational practice takes place in interaction with integrative and distributive negotiation strategies identified by Ness (2009).

The second contribution, based on our case studies, is the illustration that these relational practices evolve in relation to specific activities of MPA. The analysis of activities proved to be more relevant than phases to understand MPA's evolution. Indeed, if we used the Das and Teng's (2002) three phases model of alliance evolution to describe our findings, our cases show that fuzziness of MPA blur the lines between phases of evolution because some partners may follow parallel agendas. Thus, the trio initiation, operation, outcomes; describe actions that can occur simultaneously and thus follow a non-linear path rather than a purely chronological order. Specifically, emergent strategies (Mintzberg and Waters, 1985) occur as MPA's outcome may be achieved by subgroups alongside the initiation and the operation phases notably dedicated to strategizing. A pattern of interaction of relational practice with activities of the MPA could be described in three association. An initiation activity seems to require to apply a governance based on community associated with trust; in interaction with interpreneurship associated with authority. During this activity, an integrative negotiation strategy takes place, based on the goodwill of actors to solve an identified problem with the idea they would benefit from the collective actions. An operation activity, notably consisting of strategizing, is characterized by common governance mechanisms: community and trust allow insights collection and interpreneurship and authority govern the synthesizing of insights needed to formalize the strategy. In this activity, a consensus reaching negotiation strategy is used to achieve a collective agreement on the strategy. The outcome activity, consisting in realizing the strategy, rely on sub-group associated with price governance mechanism.

Another point that should be noted is the dual nature of the community relational practice. In our view, MPAs rely on community relational practices to achieve a common purpose.

However, more than a mean, community is also an end *per se*. Indeed, MPAs are also a platform allowing people with related business stakes to meet in a cooperative mindset. The attempts to build a community may lead to sub-group cooperation and between participants more decisively to the emergence of a consistent and competitive ecosystem comprising actors all along the value chain. This expectation existed in the two cases we studied. It raises the question of the relation between MPAs dedicated to innovation and emergence of productive ecosystems.

These results contribute to the literature by complementing research on relational practices in alliances (Ness 2009) with the multipartner relational practice. We also provide insights in the literature on MPA (Albers, Schweiger, and Gibb 2015; Provan, Fish, and Sydow 2007) by detailing the specific relational practices on which they rely and their evolution.In more practical words, our cases seem to reveal that the MPAs we observed were well designed for a collaborative strategic reflection and to serve as a platform for collaboration among participants. However, it appears difficult to perform strategic actions directly through such MPA as their organisational features hardly adapt to this task. In turn, MPAs' inability to implement concrete project risk to reduce the interest participants have in these cooperative arrangements.

Naturally, our research is limited in various aspects. First, stemming from our methodology, our results may be tightly linked to our cases. Generalizability is thus limited and the study of different empirical contexts is needed to improve it. Notably, as they are embedded in innovation policies at a national level and radical innovation context, the MPAs we studied are of a specific type. We suggested to name them national technology MPA. In other contexts, MPAs could be based on different relational practices. Moreover, national technology MPA could be different in other countries due to economic situation or political system. For example, China differs from France and the UK regarding these aspects and its national policy for additive manufacturing should be organized in a very different way. Here, our study call for other case studies and a national innovation system perspective to provide a relevant complementary theoretical understanding of national technology MPA (Lundvall, 1992, Nelson, 1993, Freeman 1995, Mowery 2011).

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