DUAL STRATEGY PROCESS IN OPEN STRATEGIZING

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ABSTRACT

This paper inductively unravels the dual process of open strategy by delving into the relationships between transparency and inclusion from a longitudinal case study. Drawing on these data, we theorize that strategy transparency affects inclusion instead of shaping the success of platform match-making services directly. By disentangling transparency into transparency of procedures and of the participants' assets/resources, and inclusion into the range of participants, participant entitlement and participant commitment, we map how sub-dimensions of open strategy influences one another. Specifically, procedural transparency influences the range of participants and participant entitlement, while transparency of the participants' assets/resources affects participant commitment. In return, inclusion influences

the development of three attributes of participants' assets/resources: variety, density and usability, which are key to platform match-making success. Our findings also suggest that open strategy does not exert a one-way influence on the development of participants' assets/resources. Instead, strategy and the attributes of participants' assets/resources are both the medium and the outcome of recursive interactions, suggesting that experimentation and reflective learning help refine open strategizing.

Keywords: open strategy, inclusion, transparency, product development, strategy process.

INTRODUCTION

Open strategy, understood as the building of greater transparency and inclusiveness into strategy-making processes, has gained a central position in the strategic management field. Strategic openness democratizes strategy making (Luedicke et al., 2017), taps into the ideas and knowledge of a wide range of stakeholders (Stieger et al., 2012) and produces better decision outcomes (Chesbrough and Appleyard, 2007). Subsequently, extant studies on open strategy have emphasized different forms and degrees of openness that seek to include previously excluded actors and improve the quality of open strategizing (Dobusch et al., 2019; Hautz et al., 2017; Seidl et al., 2019). This study builds on two broad dimensions of open strategy – transparency and inclusion – introduced by Whittington et al. (2011). It is widely recognized that opening up a strategy process in an uncontrolled manner and across both dimensions risks dysfunctional escalation of internal complexity and chaos (Dobusch et al., 2017; Hautz et al., 2017). Changing the degree of openness in one dimension generally results in changes in the other dimension. To ensure that openness is desirable and productive it is vital to understand the complex set of relationships between strategy's transparency and its inclusiveness. An examination of how two dimensions of open strategy interrelate will improve

our causal understanding of strategy processes that may oscillate between phases of extreme openness and closure (e.g. Dobusch and Müller-Seitz, 2012), and of the developmental dynamics of open strategy (Dobusch et al., 2017). Accordingly, the chief motivation of this paper is to understand how two dimensions of open strategy relate to one another. We achieve this by investigating the sub-dimensions underlying transparency and inclusion and the relationship between open strategy and attributes of participants' assets/resources that are essential to the platform match-making service in our case study.

In open strategy studies, Dobusch et al. (2017) found that most open processes are about opening up to internal organizational groups, such as employees (Stieger et al., 2012), middle managers (Baptista et al., 2017) and internal stakeholders (Luedicke et al., 2017) in the strategy process. Few studies have looked at inviting large groups of external actors to open strategy making (Dubusch and Müller-Seitz, 2012). Open strategy has rarely been examined in a platform setting. Opening up the strategy process in platforms is highly challenging. Wider inclusion of external participants (increasing variety and/or quantity) will require more sense-making for participants to come to terms with strategic issues, the coordination needed among them and conflict escalation and other tensions (Malhotra et al., 2017). Platforms rely on many types of participants taking part in activities aiming to create and capture value, which raises a series of issues concerning openness. For instance, transparency understood as visibility of information involves more than just disclosing how strategy is formulated – it is crucial to know how and what information is selected to share (Seidl et al., 2019). The platform might for instance seek to attract potential participants by revealing extensive information about strategic decisions on intended products, while sharing information about internal R&D only with those vitally involved. Besides, the degree of access to platform resources and the product information given to participants so value can be co-created is higher in platforms than in traditional (non-platform based) organizations. As with the inclusion dimension, participants'

commitment to decision making in platforms goes beyond 'low strength' – counting the number of participants' inputs but requires the qualitative depth of inclusion (Hautz et al., 2017:301). Taken together, dimensions of open strategy in platforms require a nuanced approach that captures the degree of platform openness and how much content each participant group contributes, what types of openness are offered and to how many different participant groups, and the coordinated interactions between value creation and value capture among participant groups.

If we accept the central importance of openness in the strategy process, studies of dimensions of open strategy primarily treat transparency and inclusion as separate units of analysis. To unfold how open strategy evolves we explore these dimensions in platforms, and profile the inter-relationship between them. On platforms, participants act as prosumers (Chen, 2012) in that they not only consume the platform's services but can also generate their own products: one way of looking at match-making platforms like Airbnb is to see participants as tailor-making holiday accommodation by searching for particular specifications before booking, and resolving any accommodation issues with the host during the stay. For Airbnb to function the hosts need to supply key home information to attract participants. The amount and quality of information supplied – the quality of photographs, the details and accuracy of amenities – are vital to Airbnb's subsequent pair-matching success. We use the expression 'participants' assets/resources' to describe the information, knowledge, skills, experience, technologies and assets that participants contribute to the platform. Understanding what attributes these assets/resources have, and how the development of these attributes affects changes in one of the two dimensions considered, provides a new perspective to open strategy research.

This study adds depth and breadth to our current understanding of open strategy in three ways. First, we take a granular approach, identifying five sub-dimensions of open strategy for

platforms. Our case study suggests transparency has two sub-dimensions – transparency of procedures and of participants' assets/resources – and inclusion has three – the range of participants, participant entitlements and participant commitment. These five sub-dimensions together indicate how open the strategy in our case-study platform might be. To unravel relationships and changes among these sub-dimensions we reveal how they interact and influence three attributes of participant assets/resources. Second, our conceptual model depicts a dual strategy process in platforms that adopt open strategy. That is, strategy transparency affects inclusion, and in turn, inclusion affects attributes of participants' assets/resources (that is range of participants influences variety; participant entitlement influences density and participant commitment influences usability). Conversely, our data suggest that attributes may affect inclusion and the transparency of the participants' assets/resources, but not procedural transparency. Third, instead of predetermining a 'power' that open strategy might have over attributes of participants' assets/resources, our case study data suggest that strategy and attributes influence each other, reflecting experiential learning.

The remainder of the paper is organized as follows. The first section will briefly review the literature on open strategy, and the next the research methodology, presenting the research setting, data collection and analysis. Then we take the reader through the story of *Techbridge*, introducing our historical analyses of the case. The theoretical development section follows. In the final section, we discuss what our study contributes, including the relevant boundary conditions, and highlight implications of the model for future open strategy research.

THEORETICAL BACKGROUND

Open strategy and its application to traditional organizations and platforms

Open strategy is radically different from what we know about more traditional strategizing. Classic research on firm strategies such as international diversification (Putzhammer et al.,

2019), business expansion (Deng and Sinkovics, 2017) or technological innovation (Ivus, 2015) has viewed strategies as a means for firms to develop barriers to prevent potential competition, and forge competitive advantage in the value chain, rather than embrace openness (Chesborough and Appleyard, 2007). Open strategy incorporates additional inputs into the strategy-making process, where the transparent processes, resources and knowledge are non-rival, non-exclusive and can be shared with contributors (Chesborough and Appleyard, 2007).

Extant research on open strategy has primarily put emphasis on the strategy-making process, to understand how to embrace openness to achieve process efficiency. These efficiency-centered studies tend to focus on the benefits of openness, such as untapped participant knowledge (Stieger et al., 2012), expertise (Appleyard and Chesbrough, 2017; Baptista et al., 2017) and idea generation (Chesbrough and Appleyard, 2007). This type of study typically looks into procedures to ensure that widening involvement is effective. For instance, Luedicke et al. (2017) argue that controlling practices such as agenda-setting and guiding processes may mitigate the risk that openness might prove dysfunctional. Hutter et al. (2017) highlight the importance of a community of interacting stakeholders in ongoing engagement with strategic issues in decision-making. These studies have considerably improved our current knowledge of how organizations can introduce structural mechanisms into strategy processes to achieve a desirable openness.

There are three marked differences between what open strategy means in traditional organizations, and what it means in relation to platforms. First, in traditional organizations open strategy often describes opening up strategy processes to internal groups (Dobusch et al., 2017). Baptista et al. (2017) and Teulier and Rouleau (2014) studied initiatives to involve middle managers. Stieger et al. (2012) looked at dialogues between management and employees that foster new knowledge and shared understanding to tackle organizational challenges. In contrast, platforms often seek openness to external participants, for example

inviting a broad range of participants to be part of the design and development of open system interfaces (Schilling, 2009), or releasing source code of platform products to the public to facilitate joint innovations (Eisenmann et al., 2008).

Second, when external inputs are sought, more traditional organizations may wish to limit collaboration to a defined group. Examples include collaborations between pharmaceutical companies and community organizations (Hardy et al., 2006) and joint exploration of strategic issues by groups of suppliers and customer companies from different industries (Werle and Seidl, 2015). Some organizations have used online tools to crowdsource strategic ideas but often participants are invited *either* to create *or* to validate new ideas (Hutter et al., 2017). Open strategy in platforms, however, tends not only to involve a large number of participants but also to entail deeper participant inclusion. Both Dubusch and Müller-Seitz (2012) and Malhotra et al. (2017) have shown how 'crowds' have contributed to strategic content development, looked for solutions to thorny strategic issues and taken on part of the strategy implementation processes.

Third, open strategy is often associated with issues that are relatively uncontrolled, loosely focused, requiring open sense-making with stakeholders (Dubusch and Müller-Seitz, 2012; Schmitt, 2010). Open strategy in platforms can facilitate greater scope or depth on issues emerging from opinions, ideas and interpretations offered by a broader participant base, which may challenge joint sense-making in the strategy processes. Open strategy in platforms often involves intensive real-time interactions. How to coordinate different interests and to ensure exchanges between participants to foster shared meaning are much more complicated in platforms than they are in traditional organizations.

To develop a deeper understanding of open strategy in a platform setting, the two broad dimensions of transparency and inclusion become insufficient, which has motivated this

research to take a granular approach that explores sub-dimensions and allows us to elaborate theory to address the complexity of open strategy in platforms.

Dimensions of open strategy

The concept of open strategy has been studied along the two dimensions of transparency and inclusion (Seidl et al., 2019). Whittington et al., (2011, p. 531) define transparency as the visibility of information about an organization's strategy, the process by which it is formulated and the outcomes the strategy produces. Other studies largely concur with this definition, and provide ample examples of transparency including access to sensible strategic information (Dobusch et al., 2019), transparent communication of strategy through public presentations (Whittington et al., 2016), and public announcements during merger and acquisition deals (Yakis-Douglas et al., 2017). Although procedural information concerning the formulation, implementation and decisions behind a strategy helps external participants gain understanding of the strategy process, Appleyard and Chesbrough (2017) argue that free access by outsiders to project results should be considered a key sub-dimension of open strategy. For platforms, several distinct types of participants include end users, complementors, providers who facilitate participants' access to complementary products, and sponsors who develop platform technologies. Participants possess varied resources: information, skills, experience, knowledge, technologies and assets that they could contribute to the platform. Disclosing information about participants' resources gives rise to joint sense-making about strategic issues that no participants could achieve alone. We therefore suggest a sub-dimension to transparency: transparency about the participants' assets/resources. This includes resources that existed before the platform's pair matching, so is different from procedural transparency.

With regard to inclusion, Whittington et al. (2011) mainly focus on the range of stakeholders involved. Scholars have observed other important sub-dimensions indicating the depth of inclusion, for example, distinguishing between 'low-strength' – how many times

participants input ideas or knowledge (Quick and Feldman, 2010) – and 'high-strength' inclusion – ongoing interactions and dialogues about strategy (Hautz et al., 2017), a greater qualitative depth of inclusion (Seidl et al., 2019). If open strategy is about democratic decision-making (Dobusch et al., 2019), it is important to treat participants' rights in the strategy process as a sub-dimension. A handful of studies have looked at ways in which external actors have been involved in making decisions (Dobusch et al., 2019; Kornberger et al., 2017), implicitly suggesting a democratizing process such as seeking opinions and voting (Gegenhuber and Dobusch, 2017), increasing input to decisions (Mack and Szulanski, 2017), and consensual decision-making (Luedicke et al., 2017). We draw on these studies to propose participant entitlement as a key sub-dimension, which enables us to explore systematically the power and responsibilities that external participants have, and their effect on open strategizing. One more sub-dimension added is specific to participants' responses to the rights they are given - participants' commitment. Scholars have distinguished active and passive contributions by participants to a firm's strategy process (Dobusch et al., 2019; Hutter et al., 2017). Participants' commitment illustrates the extra effort made by some to maintaining interest in the organization (Mowday et al., 1979) and it is an important indicator of the degree of strategy inclusion.

Table I summarizes the sub-dimensions developed by existing open strategy studies. Sub-dimensions used by these studies tend to follow a broad categorization of transparency and inclusion as suggested by Whittington et al. (2011). This high-level categorizations potentially excludes the opportunity to investigate more nuanced relationships between sub-dimensions.

INSERT TABLE I ABOUT HERE

Our case data analyses suggest the existence of sub-dimensions of open strategizing described in previous studies, which we acknowledge, but our analyses also enabled us to reveal previously undescribed sub-dimensions and understand known ones better. This allowed us to separate two aspects of transparency: *procedural transparency* and *transparency of the participants' assets/resources*. While the former coincides with Whittington et al. (2011) we developed the latter inductively. The data analyses also looked into inclusion at a granular level, distinguishing the *range of participants*, *participant entitlement,* and *participant commitment,* adding depth and breadth to Whittington et al. (2011). More importantly, there is scant research on how changes in one sub-dimension lead to changes to other sub-dimensions. Without understanding such relational changes in sub-dimensions our knowledge of open strategy suffers from having a static perspective presented at phases of radical openness or closure. Our inductive theoretical framework permits us to adopt a more dynamic perspective by portraying the relationships between transparency and inclusion, and investigating developmental dynamics of open strategy in a platform context.

METHODOLOGY

To study open strategy our research uses a case study design (Yin, 2011) to elicit an in-depth understanding of the sub-dimensions we have identified. A qualitative single-case study proved appropriate because data were available to investigate micro-level organizational activities (Perks et al., 2012), and actors' behaviors during specific processes (Woodside and Wilson, 2003).

Research setting

The case study explores open strategy in a platform service we call *Techbridge* for confidentiality, which has operated in the city of Xiamen in China since 2007. *Techbridge* brings together university technologies and businesses as sellers and buyers respectively.

Academics in universities hold intellectual property rights in scientific achievements or have substantive expertise and experience in their subject areas, while businesses seek to purchase either patents or technological and managerial consultancy services from those academics. Our case study is a platform that brings those academics and businesses together. The platform's product consists of matching services that match business needs with academics' technologies and knowledge. To provide these matching services *Techbridge* develops and maintains relationships with academics, businesses, banks, notary offices, technology intermediary services and law firms. It brings together different views within a multi-sided digital platform to help match pairs. This process of co-creation implies identifying, showcasing and developing patents and technologies, and business partners disclosing needs to facilitate pair matching. Examples of such pair matching are online technology transfers, payment transactions and notary services (of the transferred technology ownership).

Techbridge's business concept has several novel aspects. It challenges the traditional convention that technology transfer needs to be managed by government agencies, which guard the process of transaction heavily using physical documentation, and frequent face-to-face meetings to ensure buyers and sellers bond and work closely. Moving technology transfer online is beneficial because the service can easily be scaled up by connecting a wider range of sellers and buyers without time or geographical constraints. Overcoming the resource constraints often faced by local government agencies, *Techbridge* could draw expertise from a range of fields to support technology transfer in diverse areas at a low cost. As a platform, it provides online technology valuation, online documentation and third-party guarantees for money transactions, all of which serve as a solid foundation for its online service. By the end of 2018, *Techbridge* had registered 200,000 individual academics, 2 million businesses, more than 1,000 universities and research institutions, and over 5,000 supporting service

organizations across 100 provinces and cities and technology transactions worth USD 0.8 billion were completed on the platform in 2018.

To select a suitable case, we applied an intensity criterion to find an information-rich case where the phenomenon was manifest (Miles and Huberman,1994). First, the core business of *Techbridge,* bridging academics and organizations, operated in an open fashion. Tracking its ten-year history from inception to growth allowed us to examine how open strategizing had evolved. Second, the platform service required participants to be part of product creation, which intensified the openness. The platform product was created by pair-matching participants, making openness the ideal substrate for platform's product innovation. Third, the great variety of its participants facilitated the propagation of open strategizing. These three features of *Techbridge* make this platform information-rich, while open strategy and participant co-creation form the platform product.

Participants ranged from statutory organizations (state-owned banks), through registered or incorporated organizations (notary offices and law firms), public institutions (universities and research institutes), state-owned businesses and private businesses. This study focused on the two most prominent participant groups – businesses and academics – because they were active participants in open strategizing, and the key activities underpinning the platform product creation and development.

Data collection

Initial awareness of *Techbridge* as a platform service started when the CEO got in touch with a university in Xiamen, China. One of the authors managed to have an informal meeting with the CEO in early 2007. The CEO agreed to the study as an instance of open strategy. We recruited a local research team of four Ph.D. students in strategic management and together conducted five rounds of interviews in April–June 2009, May–July 2011, April–June 2013, April–May 2015 and July–August 2017. The study covered a ten-year period including five

rounds of interviews to accurately track the progression of *Techbridge*'s project. Each round of interviews involved a focus group with the CEO and the management team, which was followed by individual interviews. The focus group served to update the research team on the latest development of the platform service, on its major concerns and achievements. It also helped the team to compile a schedule for interviews, both internal (management, customer service and data inspection) and external (academics, university senior managers, businesses, local governments, local intermediary technology services, law firms and notary offices). After each interview, transcriptions were produced verbatim and then shared amongst the team for comments and to feed-forward. In total, 117 interviews were conducted between 2009 and 2017. Table II lists these interviews.

INSERT TABLE II ABOUT HERE

In addition to interviews, we also collected secondary data, which included 96 project minutes, and ten years of statistics on the growth of *Techbridge*. These minutes and statistics allowed us to triangulate information gathered from interviews as well as to trace changes in key areas of participant inclusion, procedural transparency and product development over time. They also helped keep the researchers up to date on development at *Techbridge* between interview rounds.

Data analysis

Data analysis followed four steps. First, two research assistants (recruited by one of the authors, who in their third year of their Ph.D. in strategic management) compiled interview transcripts, project minutes and statistics and sorted them into chronological order. This showed three distinct stages of growth. These three stages were then verified through five video conferences with the management team to identify milestones of each stage. Second, data analysis

progressed by iterating theory and data. Coding was guided by transparency and inclusion as the two broad dimensions of openness. We developed initial descriptive codes (Miles and Huberman, 1994) to uncover first-order categories from the data, then wrote up narratives to cross-check the accuracy of these categories and to clarify the theoretical themes and concepts emerging from the descriptive coding. When a category was redundant, it was collapsed into another one. It was at this stage that the new sub-dimensions for transparency and inclusion emerged. In parallel, we refined previously written narratives to help us develop these emerging candidates into second-order categories. For each second-order category we went back to the raw data to ascertain its validity. Subsequently, these candidate sub-dimensions were discussed with key informants, seeking their confirmation to improve reliability. Third, we studied the ten-year statistics of product development to classify what had been developed and compared it with the narrative. Analyses of the development suggested three attributes for the product: variety, density and usability. As before, we crossed-checked the existence of these three attributes with the management team at *Techbridge*. The data structure showing the final sub-dimensions that we use in our inductive model is presented in Figure 1. Finally, to further strengthen the relationships between strategy inclusion and product attributes derived from the qualitative case study we ran regressions to detect statistical correlations.

INSERT FIGURE 1 ABOUT HERE

In the next section, we describe the historical development of *Techbridge*, which we have divided into three stages that we have termed growing pains, growing up and firming up to address the longitudinal configuration of the data and its interlinked nature. Along with the story, we describe the state of the different sub-dimensions of open strategizing that we use in our inductive model in the subsequent section.

THE STORY OF TECHBRIDGE

We first introduce the five sub-dimensions of open strategy and three attributes of participants'
assets/resources developed inductively from coding *Techbridge* case data. Because
Techbridge's product is pair matching, attributes of participants' assets/resources refer to the
products/services that precede pair matching, such as technologies and patents on the supply
side and business needs on the demand side. Table III summarizes the main building blocks
we used to develop these sub-dimensions.

Transparency

- **Procedural transparency**. This is the visibility of information relating to the process
  of open strategizing – formulation of strategy, implementation and decision making.
  Elements contributing to procedural transparency include the range of participants to
  whom the information is circulated (developed from the quote S1PL-a, S2PT4-a), the
  issues disclosed (eligibility and entitlements – S1PL-a, changes made to previous
  decisions – S2PT4-a, reasons for changes – S2AC4) and participants' rights in
  procedural decision-making (S1AC1, *Techbridge* announcement 28 May 2014).

- **Transparency of the participants' assets/resources**. Participants' assets/resources
  are knowledge, experience and expertise that users choose to bring to the platform
  service. By supplying asset/resource information, participants engage in the open
  strategy process, because the information that participants brings to the platform affects
  the joint strategic decision with *Techbridge* regarding what match-making services the
  platform may provide. It also affects the inclusion dimension, i.e. the range of
  participants included in the information selection/supply process, participant
  entitlement (the authority participants have over selection/supply of information) and
  participant commitment (the amount of effort participants make to ensure the quality

of information selected/supplied). Our case study measures this type of transparency in terms of the disclosure of three types of information: *participant information* (participant profiles including technology-specific details such as patent certification and laboratory results, or business queries such as intention to purchase technology and business consultation – S2PL), *complementary information* (personal information of buyers and sellers, for example the participant's experience of technology transfer services, expertise in a particular field, skills at negotiating and communicating – S3PL-3) and *product performance information* (a repository of all successful pair-matching records of technologies and uses – S3DIT1 – indicating the successful utilization of participants' assets/resources).

Inclusion

- **Range of participants**. 'Range' has two meanings: the variety of professions (S1PT3) and the variety of potential knowledge inputs (S1PT4, S2PT2, S3PL-1). The latter was more significant for *Techbridge* since differences in job function, discipline and industry implied diverse knowledge resources. The range of participants shows the potential value of the knowledge and resources that the platform can draw on, so constitutes a necessary condition for strategy to be open.

- **Participant entitlement**. Entitlement is defined as platform participants' rights. It has two levels of strength: 1) entitlement by delegation, responsibility assigned by *Techbridge*, and 2) entitlement by the participant deciding to be part of the strategy-making process. The first is a low-level strength, with the scope of involvement measured by number of entitlements. The second is a high-level strength, indicated by qualitative depth of involvement (S3PL-2).

- **Participant commitment**. Commitment measures effort and time devoted by participants to design, exercise and development of entitlements and platform rules.

Efforts such as brainstorming ideas for entitlements and actively providing feedback and suggestions to improve a strategy process demonstrate participants engaging with open strategy. Commitment can be seen as participants' behavior in response to their entitlements. It can range from highly committed (see S2PT3), through moderate (S3AC10) to low (S1BM2).

By analyzing properties of product development, we observed three attributes, which we discuss next.

Attributes of Participants' assets/resources

- One attribute is the **variety** of technological fields and business areas represented on the platform. *Techbridge* recorded the number of different technology fields and business areas, and the larger the number the higher the variety for both academics (sellers) and businesses (buyers). It was difficult to quantify complementary information of participants.

- Another is **density**: the numbers of technologies or business queries registered for each technology field or business area. *Techbridge* suggested that if either total exceeded ten, then that field or business area was high-density.

- **Usability** is a qualitative attribute that refers to the relevance, accuracy, quality and usefulness of the product (S3PL-3). High usability means academic technologies and knowledge can benefit business participants. In other words, high product usability ensures pair-matching success.

INSERT TABLE III ABOUT HERE

The story of *Techbridge* shows that open strategy efforts are messy. They require experimentation and sometimes there is a need to reel back openness to establish either

guidelines or rules, which in time, may need to be changed again. Sometimes a subset of stakeholders can be more helpful while another might hinder progress. In sum, *Techbridge* set off with a partial, ill-defined, open strategy that did not produce the desired results but it followed up with targeted open-strategic efforts which ended up bearing fruit. Finally, the platform developed a balanced and controlled open strategy approach.

The *Techbridge* product was matching businesses to academics, with both participating in the process. Ultimately, businesses bought patents and technology from academics. For *Techbridge* participants' patents and technologies are important resources for pair matching. *Techbridge* needed to be able not only to attract participants but also to suggest how their patents and technologies might be adjusted to improve 'fit' and to generate business interest to encourage subsequent pair matching. This is the story we describe in detail under the three stages below, providing a description of the key constructs for each stage.

Stage 1: Growing pains (October 2008–November 2010)

With the objective to match sellers with buyers*, Techbridge*'s strategy at this stage was to generate participant profiles – gathering technologies and patents to be made available to sell but, at the same time, developing a large group of businesses which would be interested in buying them. To the project leader, the milestone for this stage was to deliver the first technology transfer via their platform and to showcase to the market that this new business model would work for traditional offline technology transfer. To this end, *Techbridge* made two decisions about transparency and inclusion:

- to publish a broad outline of the procedures to encourage product co-creation with participants (*Techbridge* could not publish any information about participants' assets/resources at this stage, since the information gathered was not yet particularly useful) and

- to make the platform open widely to all who wished to participate, and to permit key end users to be involved in the strategy-making process.

Given this autonomy, participants' commitment was low, largely because *Techbridge* offered no guidance on how commitment should be gauged. Disappointingly, no pair matching or technology transfer was achieved during this stage.

Transparency

We first present procedural transparency and next transparency of the participants' assets/resources.

High procedural transparency. *Techbridge* started by organizing four focus groups with selected academics, business owners and managers. Two perspectives influenced decisions on procedural transparency. First, academics stated that they would welcome a transparent process that provided them with feedback, which resonated with *Techbridge's* openness to co-creation because it should allow match making information to be developed swiftly. Second, academics challenged *Techbridge*'s original suggestion that a single communication channel through the platform would be most effective. Instead, they suggested multiple channels would encourage pair matching, leading *Techbridge* to explore a range of media and test their effectiveness at distributing information to different participant groups, and select channels such as offline workshops, social media, short messages, emails and the platform itself to clearly communicate that any academics and businesses could become product creators by contributing to producing pair matching. *Techbridge* also published rules regarding what academics could create and the tasks required to generate information on participant assets/resources. Moreover, it also offered open access to co-developed product information to all participants. This high transparency in procedures served two purposes: it overcame the weak perceived legitimacy stemming from market unfamiliarity with the approach, and it helped jump-start the platform service by raising market interest and enticing new participants to initiate technology pair matching.

Low transparency of information on participants' assets/resources. Both academics and businesses stated they needed to have full disclosure from business and academic participants. This request fed into *Techbridge*'s original decision. Although *Techbridge* intended to publish profiles, purchase and sales information, at first it could not publish any as poor information had been collected. Moreover, within the management team there were different views on the release of supply and demand information. The project leader felt that disclosing low-quality information would have a detrimental effect on the platform's reputation, but concerns were expressed about this contradiction of the open nature of the platform.

Inclusion

High range of participants. Wider procedural disclosure encouraged potential participants to be part of the open organizing process. This echoed the view of academics that a wider range of participants would increase search opportunities, and that inefficient search capability had been a major impediment for selling and buying technologies. The wider invitation attracted almost 6,000 registered technological competencies and over 3,000 recorded business interests. However, the management team found that data were fragmented – academics' inputs were thinly dispersed across too many technological fields and there was a mismatch between technologies on the supply side and unfulfilled demands on the buying side.

High participant entitlement. In designing participants' rights to participate, *Techbridge* worked closely with academics and business focus groups. Table IV summarizes the suggestions made by participants, and by *Techbridge*, across the three stages of platform development. At this stage, academics made five suggestions (on technology selection, supply, assessment, withdrawal and unlimited matching); businesses made three suggestions (on unlimited matching, participation in price negotiation and contract formulation). All eight

suggestions, together with the nineteen suggestions made by *Techbridge*, were formalized as participant entitlements. (see Table IV.)

INSERT TABLE IV ABOUT HERE

Low participant commitment. Although *Techbridge* hoped for responsiveness from participants their commitment was relatively low, given the autonomy they had. One explanation for this is that *Techbridge* had considerably underestimated the complexity involved in technology pair matching. They also wrongly assumed that sellers and buyers were equipped with adequate knowledge. Even though twenty-seven entitlements were offered, hardly any guidelines emerged. Participants did not know what key information needed to be included or the right language to communicate to readers on the other side of the platform. Consequently, at this stage little effort was made by participants to ensure data quality.

Attributes of participants' assets and resources

High variety. The wide participation of academics and businesses led to rapid growth in product variety. At this stage, the technologies submitted covered 1,687 fields and queries had been received in 563 areas of business. By conducting a preliminary test for pair matching, the management team discovered that business queries centered around 23 areas, and that hardly any technologies on the seller side fell within those areas. *Techbridge* took this as an important opportunity to review its inclusion strategy in the next stage.

High density. Density was understood as accumulation, either of technologies in a similar field (registered by academic participants) or of requests in a similar business area. For example, if many business participants requested process optimization applications, that business area would be regarded as high-density; likewise, if many academic participants registered process parameter solutions on the technology supply side this would increase

density of process parameter optimization. Allowing participants to generate their own profiles suggested that participants were likely to enrich these profiles by registering different development stages; this would increase density but potentially create data redundancy.

Low usability. The low participant commitment was reflected in academics simply uploading scientific publications without considering commercial aspects. This quality of information did not prompt subsequent pair matching. *Techbridge* saw information of this type as having "poor usability, low quality, vague commercial value, poor readability, and [creating a] mismatch between the supply and demand sides of technologies" [CEO, PL]. Accordingly, participants' commitment was low and no pair matching was achieved. To see examples of data segments please see Appendix 1.

Stage 2: Growing up (December 2010–July 2012)

The strategy at this stage was to act on dispersed participant information and aspire to successfully matching technologies. To do this, *Techbridge* decided to sacrifice technological variety and density for usability, to improve the transparency of its participants' assets/resources and to reduce the range of participants. Procedural transparency remained high and disclosure of information about participants' assets/resources increased considerably, but participant empowerment was cut back along with the range of participants. Even so, participants demonstrated high commitment when *Techbridge* was uncertain about particular issues.

Transparency

High procedural transparency. *Techbridge* firmly believed that the changes in inclusion (see below) needed to be publicized as a matter of urgency. To mitigate the adverse impact of major changes on the renovated platform, *Techbridge* consulted three academics who had

participated in focus groups during stage 1 to gauge how to enhance participant acceptance. Their suggestion was to communicate the rationale behind the changes, and this worked.

High transparency of information on participants 'resources/assets and match making performance. Soon after these changes were live, *Techbridge* released participant profiles (a brief description of the technology or business query) to enable and encourage pair matching. Participants had asked for these in stage 1. The focused development to encourage usability of technologies and patents around twenty-three targeted business areas began to expedite the pair-matching process, but while these successes helped restore market confidence, soon information overload became an issue. Participants reported too much information and too many profiles made searches time-consuming. *Techbridge* deliberately kept participant-specific information such as personal traits and negotiation skills in-house because such information was found essential to pair-matching success.

Inclusion

Low range of participants. To speed up pair matching *Techbridge* focused on the twenty-three business areas (demand side), trying to find adequate technological solutions to business requests, and soon prioritized a few key universities whose research areas were centered on these business areas. In the end, three universities were identified as ideal candidates. Under time pressure, *Techbridge* decided to use an institutional approach and secured agreements at the university level first. Acting in this way allowed *Techbridge* quick access to the technology pool of the faculty/department and individual academics. Accordingly, only these three universities were allowed to participate at this stage.

Low participant entitlement. To encourage pair matching *Techbridge* withdrew most of the entitlements, leaving only three for academic participants – technology supply, the right to withdraw and unlimited matching – and two for business participants – information withdrawal and unlimited matching (see Table III). Clearly, the revised participant entitlements

were narrower in scope and required little engagement by participants. Withdrawing entitlements slowed progress as the platform was obliged to input participant information itself. Accordingly, in stage 3 *Techbridge* reconsidered the option of granting participants the right to supply their own data, but under proper guidance. To this end, it worked with experienced participants to co-design a user manual to ensure the quality of participant data inputs for the next stage.

High participant commitment. We observed three examples of commitment that facilitated pair matching. First, universities and individual academics actively supplied their own technological and scientific outcomes to enable *Techbridge* to build a database on the platform's supply side. Second, *Techbridge* worked with academic and business participants who were keen to contribute, all of whom became invaluable to *Techbridge* in designing a structured user manual. The manual helped describe how participant profiles should focus on commercial usage of technology, collaboration partnerships and presentation styles, and use language that wider readerships could understand. Initially, both academics and businesses were invited to pin down missing information, unclear or vague wording, and technical jargon in sampled participant profiles. Revised versions were circulated for comment through several iterative rounds. Altogether, this co-creation process based on the interaction between academics and businesses helped develop a concise manual that only contained required information, thus reducing the time commitment from participants. Third, *Techbridge* collaborated with five technology intermediary companies to explore key issues in the online evaluation of commercial value, and in contract formulation, with the goal of encouraging pair matching.

Attributes of participants' assets/resources

Low variety. Restricting the range of participation reduced the variety of technologies and patents represented on the platform. Besides the twenty-three business areas, new

technology fields were considerably reduced to thirty-eight. To enhance their knowledge of participants, *Techbridge* started to gather complementary information such as personal preferences, traits, personality and negotiation skills of the academics because this type of information was found essential to pair-matching success.

Low density. The implication of reduced participant entitlement overall meant that *Techbridge* needed to compile individual participants' profiles on their behalf. Although sorting, categorizing and entering information were time-consuming tasks, the resulting data were free from duplications or data redundancy. Subsequently, "the density of the product [technology and patents] information was accumulated slowly and gradually" [S2PT3].

High usability. Improving data usability became the priority to sustain pair-matching growth. By controlling data inputs and selection of experts, "pair matching was fast achieved to restore confidence" [S2PL]. In particular, *Techbridge* improved four aspects of platform information:

1. *relevance* – holding the right and relevant information for participants;
2. *accuracy* – precision and clear articulation;
3. *quality* – completeness, timeliness and consistency of information;
4. *usefulness* – the commercial value of a technology or a solution.

At the end of this stage, the trade-off between high usability and low variety and density increased pair-matching success, but reduced matching efficiency. Accordingly, the focus of stage 3 was to improve matching without sacrificing data usability. For more examples of data segments please see Appendix 2.

Stage 3: Firming up (August 2012–December 2018)

The strategy here was to scale up *Techbridge*'s platform using a mix of open and closed mechanisms to strike a balance between variety and density – through openness, and usability – using systematic controls. Consequently, procedural transparency remained high, while the

disclosure of information about participants' assets/resources increased (but remained below stage 2) to foster pair-matching effectiveness. Inclusion (the range of participants and the entitlements offered) were raised back to high levels but controlled by strict guidelines. Inflexibility in these guidelines, however, reduced commitment among participants. *Techbridge* continued to rely on consultation and participant feedback for key information to help its strategy decisions.

Transparency

High procedural transparency. Procedural transparency remained high at this stage. *Techbridge* learned from the previous two stages the significance of keeping participants well informed about major changes in the range of participants and their entitlements. Interestingly, it was only at this stage that disclosure included acknowledgement of participants' inputs as a means of building confidence in the platform and appreciation by participants.

Mixed transparency of information on participants' assets/resources. While transparency of match making performance remained highly accessible, *Techbridge* noticed the downside of information overload. It then experimented with a group of participants to whom *Techbridge* first provided only five buyer's profiles in response to seller searches. If no matches were found, the next five files on buyers' information were provided and so on. This proved effective. This moderate disclosure was then rolled out to all participants and substantially improved pair-matching success. Importantly, *Techbridge* deliberately continued to keep complementary information – individual participants' personalities, habits and preferences – in-house.

Inclusion

High range of participants. Building on the successful relationship with the three universities in stage 2, *Techbridge* continued to explore institutional agreements with new

universities. This led to the decision to deploy the institutional approach formally, as an effective way to recruit participants. In addition, *Techbridge* reverted to its former policy, admitting any participants to the platform who were willing to abide by the strict rules introduced, and allowing participants to self-register, which permitted a fast accumulation of a range of technologies and patents.

Boundedly high participant entitlement. *Techbridge* extended the number of entitlements to seventeen (as compared five entitlements at stage 2), but this time within the rules and guidelines introduced in stage 2 to ensure information quality and accuracy (see Table III). Entitlements given to individual participants were constantly reviewed and revised based on usage or commitment shown. *Techbridge* also actively consulted experienced users whenever new issues or new problems emerged. Participants were once again given autonomy to select, assess and present their own information but now under strict guidelines controlled by an *ad hoc* 'customer service center'. For each academic (supply-side) participant, the platform used algorithms to detect similarities between technologies and if any technology was flagged up, an 'inspection department' carried out a manual inspection to avoid information redundancy.

Moderate participant commitment. The commitment of participants remained moderate owing to restrictions imposed by the instruction manual. To measure participant commitment, we tracked participant exercise of each 'entitlement' (as shown in their profile), then calculated the percentage of these 'fulfilled' tasks that had met the platform requirements. This figure dropped from 92% in stage 2 to 75% in this stage, while commitment extended to meeting the standard set out in the manual and no further.

Attributes of participants' assets/resources

High variety. This stage saw fast growth in pair matching both from the variety of technologies and patents on offer and from new business areas. After six years, 36,025

technology fields and 12,336 business areas had been registered. Variety was also reflected by increase in knowledge of habits, personalities and preferences, providing a competitive edge for *Techbridge*.

High density. As a consequence of broader participant entitlements, density in each technology field and business category started to accumulate. Of the newly generated technology fields, 23% reached a high density of participants within these six years, as did 34% of the business areas. The high-density percentages indicated good progress had been made to minimize data redundancy in the service system, which in turn enhanced pair-matching opportunities.

High usability. By November 2018, *Techbridge* had completed 25,000 pair matches, producing technology transfers valued at 3 billion RMB. Usability of assets/resources, in terms of high quality, relevance and clarity, enabled *Techbridge* to dramatically improve the success rate of pair-matching services to 42% for its participants. For more examples of data segments please see Appendix 3.

THEORETICAL ELABORATION OF THE FINDINGS

This section seeks to develop a conceptual model that captures the relationships between strategy transparency and inclusion, as well as the recursive interactions between open strategy and product development.

A process model of transparency, inclusion and attributes of participants' assets/resources

Our theoretical model is presented schematically in Figure 2. The model has three interlinked sections. The first two reveal a dual process: first, strategy transparency, which is composed of varying levels of disclosure of procedural and asset/resource information, and second, inclusion, which informs different degrees of participation, entitlement and commitment. The

broader the space opened by procedural transparency, the greater the impact on participation and entitlement. The more transparent the participant information, the more participant commitment. Via this behavior, the organization could develop openness, understood as organizational capacity to integrate inputs from the outside into its strategy making. Third, the resulting attributes of participants' assets/resources would be variety, density and usability, and each attribute is shaped by range of inclusion, entitlement and commitment respectively. Fourth, the recursive interactions between procedural inclusion and attributes suggests that in platforms open strategy is affected by the participants' assets/resources and vice versa. Finally, strategy transparency and inclusion define a specific profile of openness in which organizations end up having different levels of openness at each sub-dimension. Open strategizing is the outcome variable of the model, which ultimately determines a profile. Achieving different profiles will yield different forms of open strategizing.

INSERT FIGURE 2 ABOUT HERE

The proposed model posits an active and important role for transparency and inclusion in organizing open strategy (Whittington et al., 2011). Strategy making may range from a very basic level of openness to broad openness (Seidl et al., 2019). However, it can also move in the opposite direction, losing openness where the organization retrenches on inclusion and/or transparency, or decides to aim for an unbalanced development in variety, density and/or usability.

The dual process of open strategy

Our fine-grained approach allowed us to distinguish between the impact on platform match making of strategy transparency and that of inclusion. Our data analyses suggest that transparency does not exert a direct influence on attributes of participants' assets/resources.

Instead, it affects inclusion first, and inclusion in turn shapes the construction of attributes, suggesting a dual level of open strategy in managing match making success (see Figure 2).

The influence of procedural transparency on the range of participants and participant entitlement

Our case study data suggest that procedural transparency affects both participants and their entitlements. With regard to the influence on the range of participants, a wide range of issues were communicated to all related parties, which enhanced the perception that an impartial set of processes was governed by open organizing (Schappe, 1996). In the *Techbridge* case engaging participants in procedure decisions, such as the types of information to disclose and choice of communication channels, helped form an understanding of how decisions were made [S1AC1], leading to the impression that the organization was more open in handling strategy making. Academic participants remarked they were interested in *Techbridge* because transparent procedures kept them "in good faith" [S1AC4], and fostered the belief that "decisions were made jointly with participants' contribution" [S1AC2]. In the view of the *Techbridge* project team high procedural disclosure was "pivotal" at stage 1 (growing pains) to encourage a broader range of participants [S1PT-3]. The above evidence shows a causal link, in that clear procedures and participant rights stimulated co-design and development at *Techbridge*, which drew in a wide range of innovative participants.

At stage 2 (growing up), the influence of procedural transparency on the range of participants was evident in two observations. First, transparency enhanced the shared understanding of the platform's inner working and strategy progression, which helped facilitate and encourage participants to offer valuable insights into potential areas for strategic improvement. As the project leader commented "keeping your strategic processes transparent is the best way to keep everyone on the same page. Participants were motivated to provide

complementary personal information" [S2PL], which was essential for pair-matching success, and accordingly increased the range of knowledge inputs by participants. Second, transparency sent a strong message to potential participants that they would play an important role in the platform's development, according to S2PT4, which led to 38 new technology fields being added. Furthermore, when the range of participants was restricted to 23 business areas and 3 universities, some participants were regrettably frustrated. However, participants appreciated clear procedures and the sharing of the reasons behind changes [S2AC4]. Procedural transparency played a vital role in mitigating participants' anxiety and sustaining their interest in the project. In this case, high transparency not only helped increase the range of participants but also helped retain the participants recruited in stage 1.

In the end, the acknowledgement of participants' inputs online was seen as "recognition of co-creation" by the platform [S3PL-1]. New participants were encouraged by "being the driver rather than the passengers" [S3AC10]. Some participants found difficulties in following guidelines and, for this reason, potentially many participants could have been excluded. *Techbridge* updated information on new support to assist its platform participants in a timely fashion, thus avoiding this consequence and increasing the range of participants.

Procedural transparency allowed information disclosed by participants to be used to make informed decisions (Dingwerth and Eichinger, 2010) and exert influence on *Techbridge*. At the growing pains stage, participants were concerned about information asymmetry and their lack of entitlement in traditional technology transfer services [S1AC1]. High procedural transparency kept them informed about the entitlements they had and motivated them to make suggestions and thereby gain more entitlements. This is evinced by the eight entitlements that were formalized by *Techbridge* having been proposed by academic and business participants. At stage 2 (growing up), having to disclose restricted platform access for participants, as well as narrow scope and depth of entitlements, put great pressure on *Techbridge* to sustain the

entitlements initially proposed by participants. In fact, of the five entitlements retained at stage 2, four had initially been proposed by participants. At stage 3 (firming up), constant pressure imposed by fear to lose participants as a result of disclosing limits to entitlements granted to participants [S2AC4] forced *Techbridge* to revise and increase entitlement scope and depth. A broad range of entitlements, albeit bounded using strict guidelines, were reinstated in this third stage, to foster the scaling-up of pair matching, and to ensure high content usability.

How transparency of participants' assets/resources influenced participant commitment

Our case study describes how *Techbridge* intentionally concealed complementary information from both its participants and internal workers to fence off potential competition, resonating with the discussion in Dobusch et al. (2017) of selectivity of information disclosed. In contrast, *Techbridge* deliberately made information on product performance highly accessible to all participants, to build their confidence. Our study shows that whether to release participant information, and how much to release, are contingent on the quality of the information and how efficient the platform considers matching to be. During the first stage no participant information was released (owing to poor usability), and as a result little participant commitment was shown because commitment and motivation reduced when participants felt their voices were not acknowledged, or their contributions were made less visible. The decision not to disclose participant information was made to prevent reputational damage to the renewed platform, even though the disclosure of such information might help participants learn and renew engagement. In the growing up stage, when participant information was greatly improved, *Techbridge* began to publish participant profiles to reward those who actively engaged in the co-design of the user manual. Participants actively drew on their social resources and spent considerable time helping the co-design process but, when profiles became available, they started to devote more time to pair matching. During the third stage,

commitment reduced again (to moderate levels) once participants saw the tailored profiles were good enough to find potential partners and, subsequently, time and effort devoted to improving information quality also reduced.

How strategy inclusion links to attributes of participant assets/resources

Our case analyses suggest that inclusion influences three attributes of the product, and does so in three ways. First, if participants bring a wide range of technologies, knowledge and expertise to the platform, this may help increase the attribute 'variety'. As the project team leader claimed, a broader range not only increased "the number of disciplines and industries" but also "the pool of knowledge inputs that informed new trends in technology development as well as new business enquiries" [S1PL]. *Techbridge* saw rapid initial accumulation of different technology fields and business areas (i.e., it attracted a wide range of participants), but growth of product variety stagnated during the growing up stage because the focus was deliberately narrowed, meaning combined individual and institutional approaches were needed to increase the range of potential knowledge inputs and thereby drive product variety during the final stage, firming up.

In addition to our case evidence, we assessed the proposed relationship between the range of participants and product variety using Ordinary Least Squares regression analysis. We considered the number of technological fields and business areas that the range of participants registered as expertise, and the number of technology fields and business categories generated for pair matching as variety. The results suggest a positive correlation between the range of participants and the variety attribute ($\beta=0.383$, $P<0.001$ for technology fields, $\beta=0.335$, $P<0.001$ for business categories) (see Table V).

INSERT TABLE V ABOUT HERE

Second, high participant entitlement (i.e. the scope and depth of overall entitlements) may help increase product density. Initially, a high density was achieved by giving participants autonomy to input information, so that either academics or businesses could update their technological offerings or business queries frequently. This autonomy helped accumulate many similar technologies within each technological field or business area. In stage II, growing up, low density resulted from restricting the number of entitlements. In the final stage, firming up, high density was coupled with a bounded set of entitlements. To track this association between entitlement and product density we used the number of participant entitlements to denote the density attribute and regarded technology fields or business categories having more than ten counts in each field or category as 'dense'. We found participant entitlement was positively associated with product density ($\beta=0.258$, P<0.001 for technology fields, $\beta=0.319$, P<0.001 for business categories) (see Table V).

Third, the case of *Techbridge* shows that if participants are willing to devote extra effort and time to help improve the quality of the product information, it can be made useful for participants and this increases the success rate: pair matching. In our case study, during the growing pains stage unclear articulation of the potential for commercial application of technologies and poor-quality information supplied by the business participants led to low product usability and hence no pair matching. In the following two stages, usability rose to high levels once participant commitment increased to ensure information quality. To trace the relationship between participant commitment and product usability, we established the percentage of fulfilled entitlements that had met the platform requirements and used this to denote participant commitment, and the percentage of technologies successfully matched to business needs to denote product usability. We found participant commitment and product usability are positively correlated ($\beta=0.437$, P<0.001) (see Table V).

The intentionality of *Techbridge* in achieving a balanced development of attributes of participants' assets/resources

In this study, we do not observe a clear intention by *Techbridge* to shape attribute development in a pre-planned manner. Instead, the open strategizing process is messy, often characterized by trade-offs and experiential learning. The first trade-off occurred when *Techbridge* was eager to establish its digital presence by allowing a wide range of participants and numerous participant entitlements to achieve high variety and density at the expense of low usability of participants' assets/resources. Upon reflection, the project team realized that the "platform needed some control" [S1PT1]. Subsequently, low usability led to a review of inclusion; the range of participants was restricted (e.g. three universities only) and the entitlements offered to participants were limited (to five). These changes resulted in a second trade-off: substantially improved usability at the cost of stalled growth in variety and density. The unbalanced attribute development then triggered a mix of open and closed mechanisms to be introduced: openness and broad inclusion to grow the variety and density of participants' assets/resources, and systematic controls and guidelines to gauge the usability attribute.

These trade-offs illustrate that although *Techbridge* might have had an end goal – to achieve both effectiveness and efficiency in platform pair-matching – the road to get there was bumpy. Generally, *Techbridge*'s decisions on participant inclusion emerged through trial and error. Experimenting with greater and lesser inclusion was driven by successes and failures in developing attributes of participants' assets/resources and subsequent successful pair-matching. The complexity involved in open strategizing also shows that three positive associations between strategy inclusion and the attributes of participants' assets/resources do not show a one-way influence: instead, inclusion and attributes are both the media for and the outcomes of recursive interactions. However, trade-offs, experimentation and interactions made the strategy-making process richer and the quality of *Techbridge*'s pair matching better.

INSERT FIGURE 3 ABOUT HERE

DISCUSSION

Open strategy is vested in greater access to information and knowledge by including a broad range of stakeholders in strategy making (Malhotra et al., 2017). However, risks and complexity that come with open strategy also require a deep understanding of the strategizing process. This study set off to gain such an understanding, to which it makes four major contributions.

First, we unravel the relationships between transparency of strategy and inclusion in strategy. To do so, this study develops a nuanced view. In order to better understand open strategy, we delved into the relationships between the components of open strategy, to uncover its sub-dimensions. Specifically, we distinguish *procedural transparency* from *transparency of the participants' assets/resources*, confirming normative requirements of transparent strategic information made available to a wide range of stakeholders (Whittington et al., 2011; Dobusch et al., 2017), and sharing of knowledge resources (Chesbrough and Appleyard, 2007; Jeppesen and Lakhani, 2010). We suggest inclusion in strategy has three sub-dimensions: *the range of participants*, *participant entitlement* and *participant commitment*, confirming the requirements for broad participation by external stakeholders (Whittington et al., 2011), stakeholder participation in decision-making (Dobusch et al., 2019) and motivation among external stakeholders (Seidl and Werle, 2018).

Procedural transparency, as our data show, is contextual and embedded in the significance of strategic processes, which complements Seidl et al. (2019); but we posit that

the degree of procedural disclosure might be affected by the sensitivity of the information circulated and that strategic information might be revealed selectively to a restricted set of stakeholders. The second sub-dimension of transparency, *transparency of participant assets/resources*, does not diminish the ownership of knowledge or information but gives users access to such knowledge, sources without a charge (Chesbrough and Appleyard, 2007). From this study we argue that the first sub-dimension of strategy inclusion, *the range of participants*, is closer to qualitative than quantitative inclusion. A simple gathering of stakeholders who input ideas and knowledge does not necessarily lead to effective interactions (Hautz et al., 2017: 301; Quick and Feldman, 2011). Deeper inclusion rests on the degree to which participants are involved in actual decision-making. This resonates with our second sub-dimension, *participant entitlement*. Participants' decision-making rights are "an essential criterion for evaluating the openness/closure" of open strategy (Seidl et al., 2019: 11), since "taking the roots of openness into account, democratic decision-making is one of its irreplaceable pillars" (Dobusch et al., 2019: 348). The rights to make decisions are contingent and may take different forms, ranging from continuous participant interactions to occasional consultation or information support (Seidl et al., 2019). The third sub-dimension of inclusion, *participant commitment*, could be influenced by structural obstacles set by management (Stieger et al., 2012) such as lack of information, lack of power (Luedicke et al., 2017), or heavy demand or information flow imposed by open strategy (Seidl et al., 2019).

By having sub-dimensions, our model shows that procedural transparency affects the range of participants and participant entitlement. A high level of procedural transparency can be utilized to overcome weak legitimacy of a novel platform service; used tactically to hide inexperience of open strategizing; or purposefully deployed to embrace external participants. Greater transparency of participant and performance information helps generate mutual trust among stakeholders and develop commitment to business ecosystems, which speaks to benefits

of open strategy identified by Whittington et al. (2011). Despite these advantages, we learn from our case that participant assets/resources can intentionally be visible, invisible or somewhere in between, to engage participant commitment, which requires skillful manipulation of information release (what, when and how much).

Second, our study contributes by unfolding the dynamic evolution of strategy inclusion and transparency in the context of the development of participants' assets/resources and platform pair matching services. In this dual process transparency does not have a direct impact on attribute development; instead, it influences inclusion, and inclusion in turn affects the attributes. Our data analyses suggest that procedural transparency affects the range of participants and participant entitlement. In other words, the state of content development affects how open the process should be. In return, revisions to process encourage development of attributes (variety, density and usability), and that in turn offers greater value for platform participants (Kane and Ransbotham, 2016).

Third, we contribute by pinpointing three specific links between strategy inclusion and the attributes of participants' assets/resources. Our case highlights the significance of the potential resources and knowledge brought by a wider range of participants: that may lead to more meaningful variety. Besides, although participant entitlement facilitates asset/resource density, strength of entitlement is subject to participants' tolerance of extra strategy work (Luedicke et al., 2017), and their accountability for their own decisions (Oakes et al., 1998). Our study also suggests that maintaining sufficient participant commitment also maintains asset/resource usability.

Fourth, our granular approach suggests that open strategy is a continuum and the degree of openness can change across different stages of platform development in a continuum, which means that openness is neither absolute nor binary. An organization can keep some sub-dimensions more open than others. In our case, participants were entitled with considerable

authority to make a wide range of decisions in the growing pains stage, but were not allowed to reveal certain information on the platform. Similarly, in the growing up stage the rules of inclusion laid down specific conditions concerning what technologies, participants and universities could join *Techbridge*. Under these strict conditions, participants actively helped to source technologies and create a user manual, illustrating a small scale of openness within a narrower open context. Our sub-dimensions thus unravel the complexity involved in the degree of openness – maybe we cannot claim exactly how open a strategy is. The more granular and specific one's analysis, the more precisely we understand a particular aspect of openness. Moreover, the degree of openness in the different sub-dimensions varied at three stages in the development of this platform, suggesting 'open strategy is a multidimensional and dynamic set of practices' (Seidl et al., 2019: 12).

Our theoretical model sets three boundary conditions. First, *procedural transparency, the range of participants* and *participant entitlement* may apply to all types of organization using open strategy. Extant research largely concurs with this view, as it relates to transparent communication of strategy processes and decisions (Whittington et al., 2016; Yakis-Douglas et al., 2017), broader involvement of stakeholders (Baptista et. al., 2017) and consensual decision-making (Luedicke et al., 2017). However, unlike in other types of organization, open strategy in platforms is mostly externally oriented, it involves a large number of stakeholders and is developed by complex sense-making. The wider range of participants indicates the presence of a pool of personal assets – participants' knowledge, skills and experience, constituting a pre-condition for making strategy. The effort participants made, for example, to pre-evaluate the relevance and the value of their assets, to select appropriate personal assets and endeavor to share these assets with the platform instigated collaborations with *Techbridge* and other participants in making strategy. These activities grew into co-design of participant rights of decision-making, authority and obligation. Participants' entitlements included key

business decisions that were proposed and adopted by platform users, and that potentially shaped the nature and direction of platform match-making services. For example, when academics (the sellers) decided which technologies to offer, who should try to sell them, how to sell them and how much to sell, these decisions influenced the range and type of businesses (the buyers) using the platform and thus its profitability. Unlike Amazon and eBay, where product sales opportunities are foreseeable through clear product pricing and product usage, in our case study the platform has to work with participants to co-discover technology potentials, create matches and eventually develop sales opportunities. This co-creation requires commitment from participants, which is seen as embedded in the strategy implementation stage, where participants either confirm the process/rules or suggest changes. The use of both carefully selected, experienced participants to brainstorm ideas and wider stakeholders to continuously work on the ideas proposed contradicts the assumption that open strategy takes only one form, in platforms where everyone has an equal voice. Rather, participants can take various routes to be part of the decision-making process. Accordingly, procedural transparency necessarily seeks to set out clear rules determining who is doing what, and the disclosure of participants' assets/resources highlights the importance of motivation, consistency and quality of input management.

Second, on platforms the attributes of participants' assets/resources play a pivotal role in influencing open strategy. Apps for Apple's iOS provide an example. The small number of available apps led Apple to bypass its in-house app development strategy in 2007 and offer an open process incorporating a standard software development kit to ensure both quantity and quality in the apps developed using it (Evans and Schmalensee, 2016). In traditional organizations, participants mostly either generate ideas or test them, leaving organizations as the main producers. In contrast, platforms are matchmakers, acting as an intermediary to find common interests between buyers and sellers. This means that participants on platforms are

more attuned to the 'prosumer' role (Chen, 2012). An effort to achieve a well-balanced development of attributes determines the amount of value the intermediary platform can generate. Thus, a deeper understanding of how attributes of participant assets/resources and open strategy co-evolve is more important in platforms than in traditional organizations.

Third, the open strategizing we studied was based on a start-up platform whose management team lacked experience and expertise in online technology transfer business. This partly explains the evolutionary, experimental and reactive nature of the procedures by which strategy was developed. For example, failure of the ambition to promote high participation through offering twenty-seven entitlements in the growing pains stage led to most of the entitlements being closed in the next stage. However, by learning from these stages benefits of openness were reaped in the third stage and decision quality improved. Retrospectively, if open strategy had been designed around the usability of participants' assets/resources first, followed by a balance among the three attributes of participants' assets/resources, this might have helped avoid some of the mistakes made by *Techbridge* in the first stage. Our findings thus present a different view than the one proposed by Dobusch et al. (2019). Their study of Wikimedia's open strategy suggests procedures determine the direction of open strategizing, as procedures resemble rules that work through bureaucracy to stabilize new organizational capabilities (Adler and Borys, 1996), and so are required by open organizing (Dobusch et al., 2019). In *Techbridge*, we did not observe this fixed, predetermined progress via procedures to achieving milestones and thereby gauging the orientation of the open organizing process. Instead, procedures appeared to evolve experimentally and reactively. The iterations between transparency, inclusion and attributes of participants' assets/resources reflect entrepreneurial capabilities and reflective learning (McDonald and Eisenhardt, 2019) and suggest that adaptation based on learned experience will be more apt and result in improved open organizing.

CONCLUSION

Some of the limitations of our study indicate an agenda for future research. First, our study is mainly based on two participant groups. The inclusion of other participant groups might suggest a new avenue for research, perhaps including the power and influence of different participant groups and implications for the open organizing process. Second, although we used statistics to support our arguments, these arguments would require empirical testing to strengthen their validity. Finally, given the conceptual model developed in this paper, it would be natural to call for more research to extend our knowledge of open strategy and its influence on organizational performance.

Our results produce some generalizable theoretical and practical implications for traditional (non-platform based) organizations in general, and platforms that wish to adopt open strategy by including a wider range of external stakeholders. Our findings suggest that open strategy is not a binary phenomenon – open or closed. Open strategy plays a complex role in the strategy-making process, and features exhibiting high transparency (e.g. procedures in our case across all three stages) can exist simultaneously with secrecy or confidentiality (e.g. for user personal information). Open strategy therefore contains 'certain forms of openness that are related to and depend on complementary forms of closure' (Dobusch et al., 2017: 345). Trade-offs between degrees of openness or closure are in fact a simultaneous consideration of qualities brought by open and closed strategy, that eventually manage to achieve transparency and inclusivity in a more meaningful way (Dobusch et al., 2017).

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Table I Key sub-dimensions across transparency and inclusion

Theoretical lens / Sub-dimensions / Authors	Procedural transparency	Transparency to strategy content or project results	Inclusion
Appleyard and Chesbrough (2017)		The (free) access to project results by outsiders	The reliance on external assets for firm's strategizing
Baptista et. al. (2017)	Wider access to information	Wider access to strategic content	Broader involvement of stakeholders
Dobusch et al. (2019)	Access to sensible information - strategically relevant information		Modes of decision-making Status of participants -active or passive contributors
Gegenhuber and Dobusch (2017)	Transparent communication of relevant information		Asking audience for opinion and involving external audience in decision-making Active posting message versus passive reading message
Hutter et al. (2017) Luedicke			Active posting message versus passive reading message
Mack and Szulanski (2017)	Whittington et al (2011) definition		Increasing stakeholder's input for decisions Creating and sustaining a community of interacting stakeholders [Inclusion]
Luedicke et al. (2017)			Substantial participation Consensual decision-making
Whittington et al. (2011)	The visibility of information about an organization's strategy, during the formulation process and with regard to the strategy finally produced.		The scope of actors
Whittington et al. (2016)	Transparently communicating strategy through public presentations		
Yakis-Douglas et al. (2017)	Public announcements during M&A deals		
Our contributions	The visibity of information about the rules, procedures and outcomes of decion-making	The visibility of participants' assets/resources	Range of participants Participant entitlement Participant commitment

Table II: A Summary of interview schedules from 2009 to 2017

Stages	Date	Durations	Interviewees	Regions
Stage 1 (October 2008-November 2010)	April –June 2009	Between 30 minutes to 2 hours	21 interviews in total: • 1x focus group (with the CEO, project leader, two team members); • 1x project leader[S1PL] • 1x five project team members [S1PT 1-5] • 1x seven government officials [S1GO 1-7] • 1x four academics [S1AC1-4] • 1x three business owners or managers [S1BM1-3]	Xiamen, Fujian province
Stage 2 (December 2010-July 2012)	May-July 2011	Between 30 minutes to 1 hour	30 interviews in total • 1x focus group (with the CEO, project leader, four team members); • 2x project leaders [S2PL] • 1x four project team members [S2PT 1-4] • 1x nine government officials[S2GO 1-9] • 1x five academics [S2AC1-5] • 1x four business owners or managers [S2BM1-4] • 1x one bank manager [S2BM1] • 1x two intermediary service providers [S2ISP1-2] • 1x notary office [S2NO1] • 1x law office [S2LO1]	Xiamen, Fujian province, Ha'erbin, Heilongjiang province,
Stage 3 (August 2012-December 2018)	April-June 2013	Between 40 minutes to one hour	27 interviews in total • 1x focus group (with the CEO, project leader, five team members); • 2x project leaders [S3PL-1] • 1x two project team members [S3PT1-2] • 1x head of customer service center [S3CSC1] • 1x head of data inspection team [S3DIT1] • 1x six government official [S3GO 1-6] • 1x five academics [S3AC1-5] • 1x five business owners or managers [S3BM1-5] • 1x two intermediary service providers [S3ISP1-2] • 1x one notary office [S3NO1] • 1x one law office [S3LO1]	Xiamen, Fujian province, Nanjing, Jiangsu province; Zhengzhou, Henan province; Hefei, Anhui province; Wuhan, Hubei province; Nanchang, Jiangxi province
	April – May 2015	Between 30 minutes to one hour	20 interviews in total • 1x focus group (with the CEO, project leader, three team members); • 1x project leader [S3PL-2] • 1x 2 project team members [S3PL3-4] • 1x head of data inspection team [S3DIT2] • 1x head of customer service • 1x three academics[S3AC6-8] • 1x three business owners or managers [S3BM6-8] • 1x eight government officials [S3GO 7-14]	Xiamen, Fujian province; Beijing, Shanghai, Chongqing; Suzhou and Nantong, Jiangsu province
	July –August 2017	Between 40 minutes to one hour	19 interviews in total • 1x focus group (with the CEO, project leader, head of data inspection team, head of customer service center); • 1x project leader [S3PL-3] • 1x two project members [S3PL5-6] • 1x three academics[S3AC9-11] • 1x three business owners[S3BM9-11] • 1x nine government officials [S3GO 15-24]	Xiamen, Fujian province, Jinan and Yantai, Shandong province; Qingdao and Weihai, Shandong province

117 interviews were conducted from 2009 to 2017, among which 21 were in stage 1, 30 in stage 2, and 66 in stage 3.

Information gathered from local governments, the bank, technology intermediary services, notary offices, and law offices were used to help us gain a background understanding of the technology transfer business in general and the newness of this platform service. The chosen cities or provinces were guided by the platform's regional development plan.

Table III: A summary of three dimensions of open strategy and three attributes of the platform product

Primary dimension	Secondary dimension	Stage 1 Growing pains	Stage 2 Growing up	Stage 3 Firming up
Transparency	Procedural transparency • Range of audiences • Range of issues disclosed • Rights of participants' decision-making regarding processes	High High High	High High High	High High High
	Transparency of information on participants' assets/resources • Participants information • Product performance • Complementary information	Low Low Low	High High Low	Moderate High Low
Inclusion	Range of participants • Range of participant professions • Range of knowledge inputs	High High	Low Low	High High
	Participant entitlement • Scope of involvement • Depth of involvement • Rights of participants' decision-making regarding involvement	High High High	Low Low Low	Bounded High Bounded High Bounded High
	Participant commitment • Time and effort	Low	High	Moderate
Attributes of participants' assets/resources				
Variety (number of technology fields and business areas)		High	Low	High
Density (Counts of technologies in each technology field or counts of business queries in each business area)		High	Low	High
Usability (Relevance, accuracy, quality, usefulness)		Low	High	High

Table IV: Suggestions by participants and *Techbridge* and their adoption across the period studied.

	Stage 1 Growing pains	Stage 2 Growing Up	Stage 3 Firming Up
Section 1: In bold suggestions from academic participants (sellers) otherwise suggested by *Techbridge*			
1.	**The decision on which technology(ies) to sell**	Withdrawn	Reinstated: Clear guidance on the decision of which technology(ies) to sell
2.	**Supply of technology(ies)**	Sustained	Sustained
3.	**Technology assessment**	Withdrawn	Reinstated and revised based on participant's suggestion: Clear Guided technology assessment plus platform verification
4.	**Technology withdrawal –no longer wish to sell**	Sustained	Sustained
5.	Description of technology- freestyle, your technology your way	Withdrawn, but selected participants were closely involved in designing guidance.	Reinstated: Clear guidance on the description of technology – strict rules.
6.	The full responsibility of information accuracy	Withdrawn	Withdrawn
7.	The amount of information and timing to release	Withdrawn	Withdrawn
8.	Scope of information release –geographical and industrial	Withdrawn	Reinstated
9.	The creation of seller profile - seller's own choice of what to be included in the profile	Withdrawn, but selected participants were closely involved in designing guidance.	Reinstated: Clear guidance on self-creation of seller profile.
10.	**Unlimited matching with potential buyers at any one time**	Sustained	Withdrawn
11.	Choice of communication methods	Withdrawn	Withdrawn
12.	Choice of collaboration patterns	Withdrawn	Reinstated and revised based on participant's suggestion: Guidance on choice of collaboration patterns.
13.	Participation in price negotiation	Withdrawn	Reinstated: Guidance on participation in price negotiation.
14.	Participation in contract formulation	Withdrawn	Withdrawn
Section 2: In bold suggestions from business participants (buyers) otherwise suggested by *Techbridge*			
15.	Company background information – own choice what information to include	Withdrawn	Reinstated: Guidance on company background
16.	Buyer technology or technical issue request	Withdrawn	Reinstated: Guidance on company background
17.	Description of request –freestyle	Withdrawn, but selected participants were closely involved in designing guidance.	Reinstated: Guidance on the description of requests.
18.	The full responsibility of information accuracy	Withdrawn	Withdrawn

19.	Information withdrawal	Sustained	Sustained
20.	The amount of information and timing to release	Withdrawn	Withdrawn
21.	Scope of information release –geographical and industrial	Withdrawn	Reinstated: Guidance on the description of requests.
22.	The creation of buyer profile - own choice of what to be included in the profile	Withdrawn, but selected participants were closely involved in designing guidance.	Reinstated: Guidance on buyer profile.
23.	**Unlimited matching with potential sellers at any one time**	Sustained	Withdrawn
24.	Choice of communication methods	Withdrawn	Withdrawn
25.	Choice of collaboration patterns	Withdrawn	Reinstated and revised based on participants' suggestion: Guidance on choice of collaboration patterns.
26.	**Participation in price negotiation**	Withdrawn	Reinstated: Guidance on participation in price negotiation.
27.	**Participation in contract formulation**	Withdrawn	Withdrawn
This table displays all suggestions made by both academic participants and business participants presented in bold in the first and second section respectively. Suggestions presented by *Techbridge* are not in bold. For each suggestion, we track its development across the three stages of the period studied. Of importance is that in stage 2, growing up, most suggestions were withdrawn but in stage 3, firming up, many of them were reinstated with enhanced clear guidance that enabled further participation. Only essential suggestions were sustained across the three stages.			

Table V: A quantitative mapping of process inclusion to participants' assets/resources attributes

		Range of participants		Participant entitlement	Participant commitment
		Number of newly registered technology fields	Number of newly registered business areas	Number of tasks delegated to participants	percentage of fulfilled tasks that met the platform requirements
Participant asset/resource variety	Number of new technology fields	0.383*** (0.121)	-	0.057 (0.065)	0.061 (0.075)
	Number of new business areas	-	0.335*** (0.136)	0.083 (0.077)	0.104 (0.093)
Participant asset/resource density	Percentage of technology fields with more than 10 counts in each field	0.049 (0.052)	-	0.258** (0.141)	0.076 (0.069)
	Percentage of business categories with more than 10 counts in each category	-	0.072 (0.079)	0.319*** (0.152)	0.091 (0.084)
Participant asset/resource usability	Percentage of technology pair-matching success	0.067 (0.073)	0.053 (0.068)	0.036 (0.054)	0.437*** (0.092)
Model fit		N =123, F=43.54, Prob>F=0.000, R-squared =0.4724	N =123, F=39.31 , Prob>F=0.000, R-squared =0.4136	N =123, F=37.68, Prob>F=0.0000, R-squared =0.3912	N =123, F=32.72, Prob>F=0.000, R-squared =0.3750

†p< 0.10; *p< 0.05; **p< 0.01; ***p<0.001

Notes: 1) Standard errors are presented in parentheses; 2) to increase the sample size use used monthly data entries rather than yearly entries. This gives us 123 observations during the 10-year period.
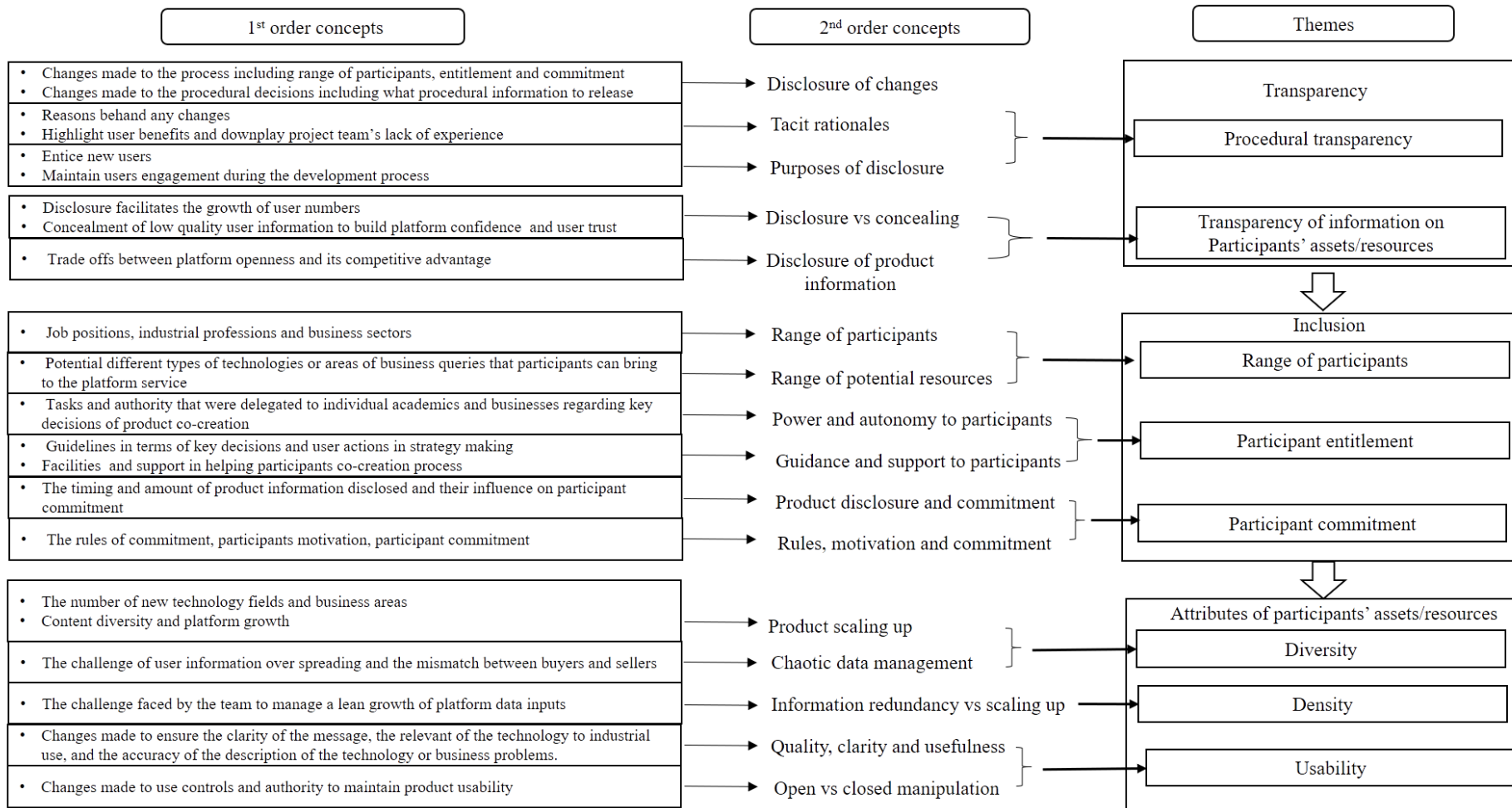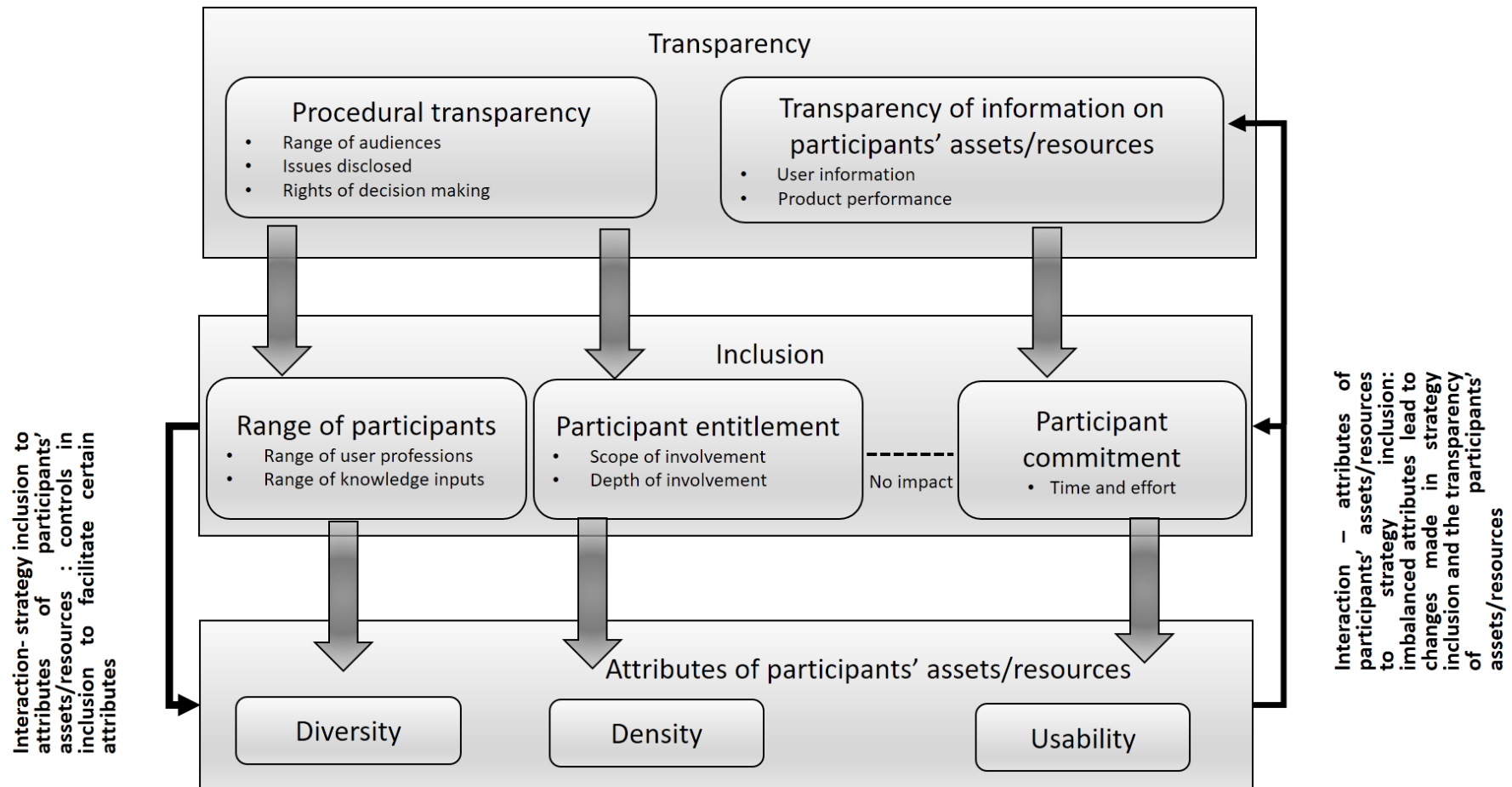
Figure 1. Data structure

1st order concepts	2nd order concepts	Themes

1st order concepts:

- Changes made to the process including range of participants, entitlement and commitment
- Changes made to the procedural decisions including what procedural information to release

→ Disclosure of changes

- Reasons behind any changes
- Highlight user benefits and downplay project team's lack of experience

→ Tacit rationales

- Entice new users
- Maintain users engagement during the development process

→ Purposes of disclosure

These lead to **Procedural transparency**

- Disclosure facilitates the growth of user numbers
- Concealment of low quality user information to build platform confidence and user trust

→ Disclosure vs concealing

- Trade offs between platform openness and its competitive advantage

→ Disclosure of product information

These lead to **Transparency of information on Participants' assets/resources**

Both under theme: **Transparency**

- Job positions, industrial professions and business sectors

→ Range of participants

- Potential different types of technologies or areas of business queries that participants can bring to the platform service

→ Range of potential resources

These lead to **Range of participants**

- Tasks and authority that were delegated to individual academics and businesses regarding key decisions of product co-creation

→ Power and autonomy to participants

- Guidelines in terms of key decisions and user actions in strategy making
- Facilities and support in helping participants co-creation process

→ Guidance and support to participants

These lead to **Participant entitlement**

- The timing and amount of product information disclosed and their influence on participant commitment

→ Product disclosure and commitment

- The rules of commitment, participants motivation, participant commitment

→ Rules, motivation and commitment

These lead to **Participant commitment**

All under theme: **Inclusion**

- The number of new technology fields and business areas
- Content diversity and platform growth

→ Product scaling up

- The challenge of user information over spreading and the mismatch between buyers and sellers

→ Chaotic data management

These lead to **Diversity**

- The challenge faced by the team to manage a lean growth of platform data inputs

→ Information redundancy vs scaling up

This leads to **Density**

- Changes made to ensure the clarity of the message, the relevant of the technology to industrial use, and the accuracy of the description of the technology or business problems.

→ Quality, clarity and usefulness

- Changes made to use controls and authority to maintain product usability

→ Open vs closed manipulation

These lead to **Usability**

All under theme: **Attributes of participants' assets/resources**

Figure 2. A model for open strategizing from a process viewpoint

Transparency

Procedural transparency
- Range of audiences
- Issues disclosed
- Rights of decision making

Transparency of information on participants' assets/resources
- User information
- Product performance

Inclusion

Range of participants
- Range of user professions
- Range of knowledge inputs

Participant entitlement
- Scope of involvement
- Depth of involvement

No impact

Participant commitment
- Time and effort

Attributes of participants' assets/resources

Diversity

Density

Usability

Interaction- strategy inclusion to attributes of participants' assets/resources : controls in inclusion to facilitate certain attributes

Interaction – attributes of participants' assets/resources to strategy inclusion: imbalanced attributes lead to changes made in strategy inclusion and the transparency of participants' assets/resources

Appendix 1: selective quotes for sub-dimensions for the growing pains stage

Sub-dimensions	Selective quotes
Procedural transparency	Participants' view point on procedural transparency "I believed one of the key issues involved in the traditional offline technology transfer services was information asymmetry. As the seller, I did not know what criteria were used to find the buyers, how commercial value was assessed, and how much I needed to pay to the intermediary company. I felt I was always in an inferior position on the negotiation table. Making information widely available would encourage participants' engagement. Also A single communication channel would not work. If *Techbridge* sent me an advert, it would go straight to delete. Offline workshops would sound more attractive to me." [S1AC1] Benefits of procedural transparency "There were several obstacles to our business concept. Selling and buying technology online was a novel service concept to the market. We could not find any similar service in the world. Moreover, the transfer service was provided by a private company, which would raise questions regarding the legitimacy of the new platform. We intended to keep procedural information widely available to all participants [current or potential]. By involving participants as part of co-creation, and by making the rules like their eligibility and entitlements clear to the participants helped build a trusting relationship with the participants. Being part of the service could also help educate the market" [S1PL-a] "I became aware of the service through a workshop organized by *Techbridge* in our university. During the workshop, it was made clear that as a participant I would have the authority to decide what technology to sell, how to sell it, and whom I would like to sell it to. I was also intrigued by *Techbridge* because it would help academics like me reach a wider participants base - similar to the way that you shopped online across the country. Its open approach – open access by everyone, and great control of information by the participants were one of the selling points to me." [S1AC3]
Transparency of information on participants' assets/resources	"Nearly all academics and business managers we interviewed agreed that a direct matching process would reduce waiting time [looking for a match]. The disclosure of participant information, therefore, became necessary. The project team did not have any objection to this proposal and an instant publication of participant information was soon decided by *Techbridge* initially." [S1PL-b] "There was very little use of the data generated. Our experts could not make a judgment of any potential commercial value of the technologies [on the seller side]. Technical jargon, unclear commercial applications, lack of indication of how to commercialize patents - all added to the problem. Similarly, the information supplied by businesses [the buyers] did not include specific requirements, for instance, technological capacity, competence, experience, of the sellers as well as the amount of investment. Besides, if we managed to clarify business needs there was no matched technology on the supply side. We could not release participant information based on these poor quality of data" (CEO, S1PL-c) "I was quite worried about how long we could hold up our participants if we decided not to release any content they supplied. If I were a seller, I would like to see my technology made available on the platform immediately. Sometimes, I wonder if we had released some of this information, would it not had served as an experiment for sellers to learn why no one was interested in their technologies?" (S1PT1)
Range of participants	"*Techbridge* was designed to cut across geographical boundaries and build a nation-wide technology transfer service. As a start, we did not set any geographical restrictions on participants. We made it open to all academics and businesses. Our initial thought was to make this platform similar to eBay allowing individual buyers and sellers to make technology transfer possible" [S1PT3]

Participant commitment	"The service [*Techbridge*] did not provide any guidance regarding how much information I was supposed to supply. We were a small, township business. Our geographical location and small scale did not make our business attractive for capital investors. Likewise, we did not have extra capital to purchase technologies but would welcome technology equity investors. This sort of information was important for technology sellers but, I was too busy and simply write down a few lines of what technology our business needed." (S1BM2)
Variety	Problems associated with variety "At this stage, we noticed that the platform needed some control. It could be quite vulnerable if we left the platform completely open to participants, as we would have no control of what data we might get. Our data entries were dispersing, non-systematic. We managed to consolidate business demands into 23 areas but found no technology supply in these areas" [S1PT1]
Density	Problems associated with density "The autonomy to self-supply information certainly improved the amount of product information in each technology field. However, potentially it created data redundancy and more work for us. For instance, for a particular project academics self-reported different stages of project developments. This in a way increased the density of data inputs but also produced redundant information. " [S1PT3]
Usability	"What a fantastic platform as I first heard of it. I used it three times by supplying my latest research. No one got back to me. I also did not know how they [*Techbridge*] would use my information. I then stopped using *Techbridge* in late 2009. There was no guideline regarding what sort of information was required. Also, I did not feel strongly committed to *Techbridge*. I uploaded three of my recent publications in top journals. There was no quality control of information supplied." [S1AC4]

Appendix 2: selective quotes for sub-dimensions for the growing up stage

Sub-dimensions	Selective quotes
Procedural transparency	"These changes [restrictions on participant access and entitlements] were necessary as we needed to quickly show the market success stories of supply-demand matching and on-line technology transfer. If we couldn't show these soon, the patience in the market would disappear. We wanted to concentrate on sorting out data quality and usability and we had to let the participant know what changes had been made."[S2PT4-a] "I felt frustrated when I found out that I was no longer able to supply my data. I did wonder if *Techbridge* was a gimmick or a scam. However, the platform did a great job explaining why changes had been made. A turning point was that *Techbridge* soon after published its first example of pairing success and to me that was critical."[S2AC4]
Transparency of information on participants' assets/resources	"We managed to release the first batch of participant profiles in a good time [five months into the second stage]. Each profile included technology-specific information like patent certification, commercial applications, and laboratory results from the academic sellers' side and clear business requests like technology purchase intent or consultation inquiries. Once the quality of the data was there and there was a fair number of technologies available, the pair-matching happened naturally. Word of mouth started to spread, and meanwhile, we heavily publicized the successful stories, which helped participant retention." [S2PL]
Range of participants	"At this stage, we were not keen to further expand the range of technologies but to consolidate the match between the supply and the demand. We only granted platform participation for those academics that we had chosen and whose expertise fell within the twenty-three business areas in three universities. This worked as the demand-oriented approach allowed us to quickly identify the right academics who had the right technologies to supply." (S2PT2)
Participant entitlements	"A bilateral service agreement between the university, the senior management team, and *Techbridge* helped access to schools' pool of technologies. But for each school, it took a long time for us [*Techbridge*] to enter their information. This would not work if data entry was done all by ourselves. We needed to find a way to bring back participant rights and guide participants to do things by themselves." [S2PT3]
Participant commitment	"The participant manual was co-designed and developed with experienced participants. Academics were willing to spend time helping us to get the guidelines right. […] For instance, we learned some key items that must be included in our participant manual were a formal letter, a prototype or at least a good drawing of the product, and a list of manufactures and potential participants of the patent." [S2PT3]
Variety	"We had a good deal of purchase intentions. However, many of these intentions did not materialize. For instance, some academics were not good communicators. Naively they could be arrogant when talking to a client. Such an attitude would easily annoy the buyer. Technology purchase was in some way similar to a date - two parties needed to get on with each other. This made us to collect participant personal information [adding data variety] to help with matching success" [S2PT4-b]
Density	"The institutional approach [university acceptance of *Techbridge*] helped the growth of data density, particularly when we were able to access to school's record of research projects. For each school, there was a series of project families, which increased data frequency in a specific technology field. However, the data entry took time so the growth of data density was slow." [S2PT2]
Usability	"Compared to the last stage, when we had no match-pairing success, we achieved a rate of 63% matching success in stage 2, the highest among three stages. Eventually, *Techbridge* needed to revert and give more authority to participants. A key question to answer was how to maintain openness and quality at the same time? A participant manual could be the solution as it provided clear guidelines and allowed participants to follow instructions to self-create their profiles". [S2PT1]

Appendix 3: selective quotes for sub-dimensions for the firming up stage

Sub-dimensions	Selective quotes
Procedural transparency	The acknowledgment of participant contribution was evident in procedural disclosure "From 1st June 2014, for non-patented technology solutions, the technology owner needed to supply two professional guarantors so that referees could be contacted to ensure technology quality and information accuracy. We thanked Professor Liu and his team from the South China University of Technology for this suggestion." [Announcement 28th May 2014. Techbridge Archive]
Transparency of information on participants' assets/resources	"We first supplied each buyer with the top five matches. If no pairing was found, we provided another five. Our experience taught us that by supplying 10 matches, businesses would either secure a deal or there was no match in our database. Participants also had free access to our archive for all successful matching cases." [S3DIT1] "Personal information was strategic and crucial for a deal for instance participants' experience [of technology transfer services], knowledge expertise [for the area of consultancy], personal traits, communication and negotiation skills. Internally we only allowed the case manager or caseworker to access a participant's personal information. If someone left the company, he could potentially take a few participants with him but not all." [S3PL-3]
Range of participants	"Three decisions were made at the end of this meeting. First, *Techbridge* would formally seek institutional agreements with eleven universities to ensure academics have fast access to *Techbridge*'s services. Second, *Techbridge* gave access to all individual academics whose institutions had not yet reached any agreement with *Techbridge*. Third, to guide participant actions, *Techbridge* would provide clear instructions and implement information checkpoints." [Meeting minutes on 16 April 2013. *Techbridge* Archive] "The only way to massively increase the breadth of product information was to allow individuals to create their profiles. The institutional approach was effective to address business queries centered on a particular area. By having both approaches we were able to rapidly accumulate a wide range of technologies."[S3PL-1]
Participant entitlement	"It was collaborative effort. On the one hand, we maximized participants' involvement allowing participants' to self-generate their own profiles according to strict guidelines. On the other hand, we spent a lot of time and effort to ensure that data entered into the platform were useful and, clean. The on-line platform demanded high-quality information. Otherwise, we wouldn't build our reputation and trust among customers."[S3DIT1]
Participant commitment	"Once the rules had been set out, people would tend to follow the rules rather than challenge the rules for improvement. For me, the ultimate goal was to use the platform to sell my patent. As long as my profile met the required standard, I wouldn't do more than that." [S3AC10]
Variety	"Thinking of future competition, how would we compete against university consortia or government organizations who wish to offer similar services? I'd say we know our customers well [their personal preferences and habits]. The broad spectrum of technology fields, business areas, and our knowledge about our participants allow us to find the right partners for them [participants], and to maximize their potential or resolve their business problems." [CEO]
Density	"With guided, self-profile creation, *Techbridge* started to build up product density rapidly. Increased density in each technology field helped scale up the service." [S3DIT2]
Usability	"The platform had been experiencing healthy growth. We aimed to achieve over 80% of pair-matching. This target could only be achieved if we continuously improved product usability. We strove to ensure that information stored in our system was accurate, complete, up-to-date, relevant, and reliable. Most importantly, the information would potentially generate value for participants." [S3PL-3]