



Three Essays on Governance Designs in Digital Age

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Par

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Three Essays on Governance Design in Digital Age

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Composition du Jury :

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M. Olivier FAVEREAU	Professeur émérite des Universités, Paris X	Rapporteur
M. Denis SEGRESTIN	Professeur émérite des Universités, Sciences Po. Paris	Rapporteur
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ABSTRACT

The main objective of this dissertation is to explain why coordinative efficiency, creative efficiency, together with static efficiency are all critical goals of governance design in digital age, and to explore innovative governance arrangements, beyond the one-dimensional line defined by “market” and “hierarchy”, that can facilitate the processes of integrative coordination, and collective creation in organizations.

The dissertation is composed of three essays. Essay 1 is a theory paper that provides the overall theoretical arguments about why transaction cost economics (Williamson 1979, 1991, 1996, 2002) is no longer a satisfactory theoretical framework for governance design in the digital age, and offers a normative model which suggest possibilities of much more nuanced, complicated and pluralistic governance choices than suggested by transaction cost economics. It is argued that potential governance choices are not solely situated on a one-dimensional line between hierarchy and market, as transaction cost economics asserts. The rich connotations of socially constructed agency (Giddens, 1985; Greenwood et al. 2011) provide diverse possibilities of governance arrangements, which spread across a triangular plane in a three-dimensional space defined by static efficiency, coordinative efficiency and creative efficiency (see Figure 1). This paper provides both graphic and mathematical presentations of this three-dimensional model for governance design, which can be applied to different levels of organizing.

Essay 2 and 3 are two empirical papers that endeavor to extend Essay 1 by finding out the exact relationship between certain innovative governance arrangements with organizations’ performance in coordinative and creative efficiencies. Essay 2 focuses on the realization of integrative coordination in organizations. It found out that layered distributed organizational

structure (Simon, 1962), broad-brushed ex ante plan (Edmondson, Bohmer and Pisano, 2001), and semi-structures (Brown and Eisenhardt, 1997) are beneficial in facilitating an ongoing coordination process when interdependencies are complex and uncertain. Essay 3 focuses on organizations' performance in collective creativity (Shalley et al., 2004; George, 2007), especially on what governance arrangements can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency. It is discovered that “ordered disruption”, including ordered spatial disruption, ordered temporal disruption and ordered affective disruption, have positive effects on the emergence of collective creativity. Both Essay 2 and Essay 3 use collaborative organizations on smart city projects as the empirical setting. The findings of these two empirical papers are grounded on multiple case studies on those collaborative organizations.

Keywords: governance design, static efficiency, coordinative efficiency, creative efficiency, collective creativity

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SYNTHESE

Le principal objectif de cette thèse est d'expliquer pourquoi l'efficience de coordination (coordinative efficiency), l'efficience créative (creative efficiency), ainsi que l'efficience statique (static efficiency) jouent un rôle déterminant dans la conception de la gouvernance à l'ère numérique. Il s'agit également d'étudier des mécanismes originaux de gouvernance, au-delà de la traditionnelle dimension marché-hiérarchie, pouvant faciliter les processus de coordination intégrative (integrative coordination) ainsi que de création collective dans les organisations.

La thèse comprend trois essais.

Le premier est une contribution de nature théorique montrant que l'économie des coûts de transaction (Williamson 1979, 1991, 1996, 2002) ne permet pas de rendre compte de façon satisfaisante de la conception de la gouvernance à l'ère numérique. Le modèle conceptuel normatif proposé contribue à repenser celle-ci dans une perspective pluraliste intégrant complexité et variété. Les choix de gouvernance ne sont ainsi plus limités à la seule dimension marché-hiérarchie comme le laisse penser l'économie des coûts de transaction.

Au moins trois hypothèses de base sur lesquelles repose l'économie des coûts de transaction peuvent être questionnées, ce qui contribue à affaiblir le pouvoir explicatif de cette approche.

Tout d'abord, les agents économiques sont présentés comme égocentriques et opportunistes (Williamson, 1991). Ainsi, la principale fonction de la gouvernance serait de contrôler le risque de voir les agents adopter de tels comportements face à l'incertitude. Cependant, les chercheurs en psychologie sociale et en psychologie évolutionniste ont prouvé depuis longtemps que les êtres humains peuvent se comporter de façon altruiste, coopérative et

sans rechercher un intérêt économique. Même en admettant que tous les acteurs humains seraient égocentriques et ne poursuivraient que la maximisation de leurs intérêts économiques, il n'en demeurerait pas moins que ceci s'inscrirait dans des systèmes relationnels et sociaux complexes et que les comportements seraient inévitablement affectés par des facteurs non économiques au sens strict, tels que le capital relationnel ou social, les contextes institutionnels ou encore la logique des obligations réciproques, (Poppo et Zenger , 2002 ; Johnston et al., 2010).

Deuxièmement, l'économie des coûts de transaction, comme la plupart des théories économiques néoclassiques, a tendance à supposer que le marché est l'institution la plus efficace pour accueillir des activités économiques (Hayek, 1945 ; Williamson, 1981). Toutefois, les organisations sont des institutions venant compléter le marché quand celui-ci vient à défaillir. A ce titre, elles assurent une fonction d'appropriation et de création de valeur même si ce rôle a été largement ignoré (North, 1990).

Selon Moran et Ghoshal (1999), il convient de distinguer deux catégories permettant le déploiement des ressources : les échanges et les combinaisons. Le marché est une institution puissante qui permet l'échange bilatéral et ainsi facilite l'allocation efficace des ressources. Mais la création de valeur repose avant tout sur les différentes façons de choisir les ressources, et leur transformation en biens et services, ce qui nécessite une mobilisation d'efforts collectifs basée sur une combinaison de ces ressources (Moran et Ghoshal, 1999). Ces auteurs identifient trois conditions nécessaires afin qu'une telle combinaison puisse se réaliser dans l'univers économique. Tout d'abord, toutes les ressources à mobiliser doivent être disponibles. En second lieu, la réalisation de cette combinaison requiert une motivation. Par ailleurs, les biens ou services produits par cette combinaison doivent être valorisés. Les marchés aussi bien que les organisations sont nécessaires à l'accomplissement de ces trois conditions. Alors que les marchés

sont efficaces dans l'allocation des ressources, les organisations sont là pour amasser ces ressources et les mobiliser de façon coordonnée. Alors que le marché contribue aux activités économiques en permettant les échanges bilatéraux, les organisations offrent les contextes institutionnels permettant la réalisation d'objectifs collectifs. Marchés et organisations sont des institutions indispensables à la création de valeur. Dans ce contexte, il conviendrait de prendre davantage en compte les logiques organisationnelles contribuant à la recherche d'appropriation et de création de valeur.

Enfin, l'économie des coûts de transaction ne s'intéresse qu'à la notion d'efficacité statique, c'est-à-dire comment optimiser l'allocation d'un niveau donné de ressources, avec un certain degré de spécialisation, à un moment donné dans le temps. Ce point de vue est sérieusement limitatif. Non seulement le pool de ressources disponibles, voire leur rareté, peut varier au fil du temps, mais la stratégie organisationnelle consiste avant tout à gérer un processus concurrentiel dynamique, assurant la pérennité de l'entreprise. Dans la littérature en management stratégique, le courant de recherche qui met l'accent sur l'adaptation et la création de valeur avec des environnements changeants a connu un rapide développement (Teece, Pisano et Shuen, 1997 ; Galunic et Eisenhardt, 2001). Bien que l'efficacité statique joue toujours un rôle important, l'avantage concurrentiel des entreprises dépend de plus en plus des capacités intégrative et créative. Comme indiqué précédemment, les organisations sont des institutions indispensables à la recherche de nouvelles combinaisons de ressources (efficacité créative) et à la réalisation de processus collectifs qui intègrent ces ressources dans des biens et services valorisés (efficacité de coordination). La structure de gouvernance, comme cadre général qui « confère aux organisations leur autorité et leur mandat à agir » (McGahan, 2014), joue un rôle essentiel en permettant aux acteurs organisationnels de créer des combinaisons valorisables. C'est

précisément l'essence même de ce que Schumpeter appelle « destruction créatrice » (Schumpeter, 1934, 1947). En cohérence avec la notion d'efficacité adaptative proposée par North (2010), l'efficacité de coordination et l'efficacité créative rendent grâce aux rôles joués par les processus d'évolution et la diversité des contextes. Les organisations ne sont alors plus considérées comme une réponse aux failles du marché, mais comme des entités capables de combiner des ressources pour en créer de nouvelles et générer de la valeur. Adopter une perspective plus dynamique de l'efficacité élargit les possibilités théoriques pour expliquer la diversité des formes d'organisation et de structures de gouvernance.

La thèse soutient que les formes de gouvernance qui peuvent survivre à une concurrence féroce et un environnement en mutation rapide sont celles qui tiennent compte de ces trois formes d'efficacité. Cela est vrai quelles que soient les époques. Toutefois, la montée en puissance et l'application à grande échelle des technologies numériques rendent cela encore plus pertinent pour différentes raisons.

Tout d'abord, un vaste corpus de recherche économique, en particulier l'économie néoclassique, repose sur l'analyse marginale d'un système de prix basé sur le marché concurrentiel. Le marché, en concurrence parfaite, est considéré comme une institution efficace en matière d'allocation des ressources. C'est ce à quoi fait référence la célèbre métaphore de « la main invisible » d'Adam Smith. Toutefois, l'information est une ressource particulière. Son utilisation n'a pas d'impact sur le stock disponible (Samuelson, 1954 ; Ostrom et Ostrom, 1977 ; Ostrom 2006 ; Sandler 1986, 1992). En terme économique, le coût marginal lié à la fourniture de cette ressource à un utilisateur supplémentaire est égal à zéro (Samuelson, 1954 ; Sandler, 1986). Cette caractéristique remet en question le rôle du marché dans l'allocation efficace de celle-ci dans la mesure où son coût marginal n'est plus égal au revenu marginal que l'on peut en tirer

(Bates, 1985). Qui plus est, lorsque des « rivalrous resources » sont négociées sur un marché concurrentiel, l'équilibre du marché correspond à l'allocation optimale de ces ressources en terme de bien-être social. Là encore pour l'information en tant que « non-rivalrous resource », l'allocation optimale n'est possible que lorsqu'elle est offerte au public avec un accès libre et à prix nul. Le raisonnement est simple. Lorsque la ressource n'est pas en rivalité et que les coûts de reproduction et de transfert sont égaux à zéro, n'importe quel individu ou entreprise qui peut en tirer profit devrait y avoir accès, afin de maximiser la performance sociale. Grâce à cette caractéristique, la donnée (data) en tant que ressource, disponible et en libre accès, ne provoquerait pas « la tragédie des biens communs » (Hardin 1968, 1994). Contrairement aux terres de pâturage de Hardin, l'augmentation du nombre d'utilisateurs n'en diminue pas le stock disponible, mais contribue à augmenter la création de valeur.

Cependant, les données ou informations ne sont pas naturellement des biens publics en ce sens qu'elles sont « excluable ». C'est-à-dire qu'il est possible d'empêcher des particuliers ou des entreprises d'y accéder s'ils ne sont pas prêts à en payer l'accès (Samuelson 1954 : 387-389). La plupart des données, surtout les « big data », ne sont pas produites intentionnellement. Elles sont en quelque sorte des sous-produits ou produits dérivés d'autres activités. Néanmoins, certaines plates-formes, comme Facebook ou Google, sont mieux placées que d'autres dans la collecte des données et ont la capacité à en garder l'exclusivité. Ainsi, ces détenteurs peuvent tirer profit de ce monopole en renforçant leur avantage concurrentiel. Facebook, par exemple, fournit des services de publicité ciblée plus performants que bon nombre de ses concurrents et ce, en grande partie grâce à la possession et l'analyse de big data générées par les activités de ses utilisateurs. Toutefois, ces droits monopolistiques sont à la fois difficiles à conserver et destructeurs de valeur au niveau de la société. Les données ou information pouvant être

reproduites et transférées à coût nul, la rente liée au monopole disparaît dès lors que le marché devient ouvert. Plus important encore, la valeur des données n'est pas définie ex ante, mais est liée à la capacité des analystes à les exploiter de façon créative. Toute propriété privée des données ou informations est de nature à détruire de la valeur au niveau de la société car elle interdit aux autres individus et entreprises de créer davantage de valeur par une utilisation créative.

En second lieu, les données, en tant que ressources, mettent davantage en exergue l'importance de la créativité dans les organisations. En tant que telle, la simple détention d'une donnée ne crée pas de la valeur, ce sont les efforts créatifs déployés dans son utilisation qui peuvent être créateurs de valeur (Drucker, 1998). Cette créativité peut provenir de l'exercice d'une autonomie individuelle mais aussi de processus organisationnels collectifs. L'agency est définie comme la capacité des acteurs à agir sur la structure sociale (Giddens, 1985). Une économie basée sur l'exploitation de données repose sur des compétences créatives et des connaissances spécialisées en matière d'identification et d'extraction de celles-ci, ainsi que sur la capacité à en trouver des usages innovants. Ceci requiert la mobilisation d'équipes de spécialistes à tous les niveaux. Dans les organisations actuelles, l'agency n'est pas juste un facteur humain qu'il convient de contrôler, mais peut constituer, si géré correctement, une véritable source d'avantage concurrentiel. Dès lors, si l'agency permet d'exploiter la valeur cachée dans les données, en quoi l'organisation collective est-elle utile dans ce processus créatif ? Il convient de reconnaître qu'avec l'accroissement de la complexité des problèmes dont veulent se saisir les êtres humains, il est de plus en plus rare pour un seul individu de posséder les connaissances et expertises nécessaires. L'accomplissement de ces tâches complexes nécessite des connaissances

et l'expertise provenant d'une variété de disciplines et de perspectives (Bissola et Imperatori, 2011).

Comme les insights créatifs proviennent souvent de la confluence d'idées existantes (Hargadon et Bechky, 2006), la créativité est de plus en plus le produit d'efforts collectifs. Bien qu'apparentés, la créativité individuelle et la créativité collective sont deux phénomènes distincts. La créativité collective ne se résume pas à un simple agrégat de la créativité cumulée de tous les membres de l'organisation (Taggar, 2002). Elle provient de la pertinence des « interactions entre les participants engagés dans un processus de résolution de problèmes » (Hargadon et Bechky, 2006:487) et mérite toute l'attention des chercheurs en gestion. Les technologies digitales catalysent les changements dans tous les secteurs d'activités. Afin de rester compétitives, les entreprises doivent démontrer leur capacité à mobiliser la créativité tant au niveau individuel que collectif.

Enfin, les technologies digitales modifient les modes de coordination sociale. Non seulement elles réduisent considérablement les coûts de communication et de transaction, mais elles requièrent et permettent à la fois la réalisation de tâches interdépendantes caractérisées par leur haut degré de complexité et d'incertitude. Comme la logique de production est passée de la maîtrise de l'engineering à celle de l'information, le travail est devenu de plus en plus axé sur les connaissances et la créativité. Les solutions simples ne suffisent plus, et les processus requis sont difficiles à estimer (Kraut et Streeter, 1995). Les tâches interdisciplinaires requièrent une collaboration entre divers spécialistes, et la nature du travail est de plus en plus ambiguë, imprévisible et difficile à mesurer. En outre, les récents développements technologiques permettent d'intégrer des tâches, des organisations, voire des secteurs d'activités qui ne l'étaient pas par le passé, afin de réaliser des objectifs à finalité sociétale. Les transactions et les

collaborations dépassant les frontières entre entités, qu'il s'agisse de business units, d'organisations, de secteurs voire de pays, sont devenues monnaies courantes, grâce à des interfaces standardisées et des moyens de télécommunication accrus (Walldorf et Rivkin, 2005). Si l'on prend l'exemple des solutions urbaines, avec le big data et les technologies de l'information et de la communication, il est possible aux municipalités d'appréhender de façon intégrée les différentes facettes de la vie urbaine, qu'il s'agisse du traitement de l'eau ou des déchets, de l'énergie ou encore des transports. Par l'intégration de diverses données et informations dans une même plate-forme, les villes peuvent être plus efficaces, plus inclusives, plus pratiques, et in fine plus agréables à vivre. En un mot, elles peuvent être « plus intelligentes ». Ces projets de « villes intelligentes » ne peuvent être réalisés par une entreprise seule. Les frontières floues entre organisations remettent en question certains mécanismes de coordination intégrative très répandus dans les entreprises avec une hiérarchie formelle. Dans son travail empirique, Metiu (2006) a montré que mettre en place des mécanismes formels indiquant la différence de statuts entre unités peut nuire au sens de l'autonomie des différents groupes impliqués et provoquer des problèmes de coordination.

Toutes les observations susmentionnées indiquent qu'il est plus difficile de travailler comme à son habitude (business as usual) à l'ère digitale. La gouvernance ne porte plus uniquement sur une logique de contrôle. La conception de la gouvernance organisationnelle doit permettre et inciter les efforts spontanés et créatifs de tous les membres de l'organisation. Les processus organisationnels ne peuvent plus être linéaires et claires, mais probablement flous et expérimentaux. Si l'on considère que les membres d'une organisation sont inspirés par une orientation stratégique partagée, il est nécessaire de reconnaître qu'aujourd'hui, les résultats attendus ne peuvent pas totalement être définis ex ante, mais vont être émergents au cours du

processus. Les analyses ci-dessus indiquent l'importance des processus de coordination intégrative et de création collective. Ils correspondent aux axes d'efficacité de coordination et d'efficacité créative dans le modèle proposé dans l'essai 1. Ils sont également discutés dans les essais 2 et 3.

Ces deux essais sont à dominante empirique. Ils visent à prolonger le premier en étudiant le lien entre des configurations innovantes de gouvernance et la performance des organisations en matière d'efficacité de coordination et d'efficacité créative. Le matériel empirique utilisé est basé sur une étude des modes de gouvernance de différents projets de villes intelligentes nécessitant une collaboration entre plusieurs organisations.

Avec l'émergence de ces villes intelligentes, un nouveau secteur d'activités apparaît, impliquant organismes publics et entreprises privées. Ces organisations travaillent de concert à la recherche de solutions nouvelles permettant d'améliorer la qualité de vie urbaine. Cela exige non seulement l'utilisation de nouvelles technologies, mais également le développement de business models originaux permettant d'assurer la conception, le financement et le déploiement des tels projets urbains. Les villes intelligentes constituent un terrain des plus pertinents pour étudier la créativité collective. Ils requièrent, en tant que grands projets, une approche systémique des différentes tâches à réaliser et la mobilisation d'une large variété de compétences détenues par différentes acteurs.

Qui plus est, le processus de réalisation d'une ville intelligente permet d'illustrer le principe de coordination intégrative dans le cadre d'un projet systémique prenant appui sur les technologies de l'information et de communication. C'est ainsi que l'ampleur d'un tel projet incite plusieurs acteurs, n'ayant pas nécessairement l'habitude de travailler ensemble, à coopérer. Les tâches à réaliser requiert la mobilisation de compétences parfois proches ou complémentaires,

ce qui remet en question le principe d'étanchéité des frontières inter-organisationnelles. La réussite du projet dépend de la capacité de ces différents acteurs à réaliser des tâches souvent interdépendantes et difficilement planifiables ex ante de par sa nature créative (Kraut et Streeter, 1995). Pour toutes ces raisons, une recherche empirique basée sur des projets de villes intelligentes fournit un cadre également très pertinent pour étudier la coordination intégrative.

Le choix de réaliser une étude de cas multiple prend appui sur les recommandations formulées par Edmondson et McManus dans leur article « Methodological Fit in Management Field Research » publié dans l'Academy of Management Review en 2007. Dans ce papier, ils montrent quelle approche méthodologique est la plus pertinente en fonction des particularités du champ de recherche concerné. Pour eux, le bon choix méthodologie, qu'il s'agisse d'approches qualitatives ou quantitatives, dépend de la maturité des cadres théoriques existants. Lorsque le sujet de recherche s'appuie sur des théories matures, des méthodes à dominante quantitatives sont plus appropriées. L'objectif principal s'inscrit dans une logique de validation du cadre conceptuel ou d'enrichissement de celui-ci. Les théories naissantes, les domaines de recherche encore peu étudiés, requièrent l'utilisation de méthodes qualitatives permettant aux chercheurs d'explorer diverses possibilités et construire des cadres théoriques. Une telle perspective s'apparente à une logique d'enracinement de la théorie (grounded theory).

Bien que la conception de la gouvernance ne soit pas un nouveau sujet de recherche, l'avènement de l'ère numérique invite à revisiter les principes d'organisation et la nature de la gouvernance qui leur sont liés. Dans ce contexte, il ressort que les questions de recherche soulevées dans cette thèse n'ont pas encore été suffisamment étudiées pour considérer qu'il existe des cadres théoriques robustes. Dès lors, les deux essais empiriques adoptent une approche enracinée de nature qualitative et basée sur des études de cas.

Lorsque l'enjeu est de contribuer à l'émergence d'un cadre théorique, une telle approche s'avère très puissante (Eisenhardt, 1989 ; Eisenhardt et Graebner, 2007), permettant une étude minutieuse et rigoureuse des riches données collectées sur le terrain. En comparaison de l'étude de cas simple, l'étude de cas multiple présente l'intérêt de pouvoir engager le chercheur dans une logique de réplification (Yin, 1984 ; Eisenhardt, 1989 b). Ainsi, l'étude de cas multiple permet d'examiner la « réplabilité » d'une conclusion. En conséquence, l'étude de cas multiple peut mener à des découvertes plus « solides », possédant par là-même la capacité à générer de nouveaux cadres théoriques. Pour toutes les raisons mentionnées ci-dessus, la partie empirique de cette thèse prend appui sur la méthodologie d'étude de cas multiple.

Le deuxième essai se concentre sur la coordination d'intégration dans les organisations. Des structures organisationnelles distribuées à plusieurs couches ou *layered distributed organizational structures* (Simon, 1962), des plans définis ex ante de façon imprécise ou *broad-brushed ex ante plans* (Edmondson, Bohmer et Pisano, 2001), ainsi que des *semi-structures* (Brown et Eisenhardt, 1997) s'avèrent utiles au processus de coordination lorsque les interdépendances sont complexes et incertaines.

Le troisième essai porte sur la performance des organisations en matière de créativité collective. Il s'intéresse notamment aux dispositifs organisationnels facilitant l'émergence d'une telle créativité tout en préservant stabilité et efficacité. Plusieurs formes de perturbation qualifiées d'ordonnées (*ordered disruption*), tant au niveau spatial (*ordered spatial disruption*) que temporel (*ordered temporal disruption*) et affectif (*ordered affective disruption*), contribuent à l'émergence de la créativité collective.

Cette thèse contribue à faire progresser la connaissance en matière de conception de la gouvernance en remettant en question l'approche unidimensionnelle basée sur la seule recherche

d'efficacité statique. Elle propose une perspective multidimensionnelle, diversifiée et dynamique, davantage appropriée à la nature changeante des modes d'organisation et de gouvernance à l'ère du numérique. Combinant les théories évolutionnistes et celle de la complexité afin de rendre compte de la gouvernance organisationnelle, elle apporte une réelle contribution en mettant à jour des modes innovants de gouvernance. Ceux-ci facilitent les processus organisationnels capables de réconcilier les trois formes d'efficacité : statique, de coordination et créative.

CHAPTER 1:

Introduction

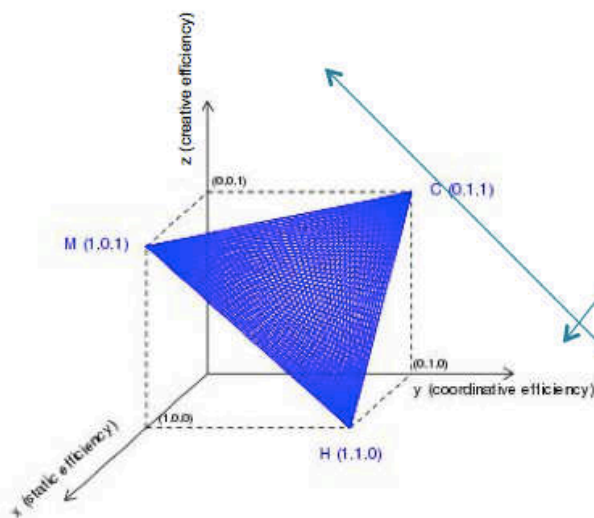
The main objective of this dissertation is to explain why coordinative efficiency, creative efficiency, together with static efficiency are all critical goals of governance design in digital age, and to explore innovative governance arrangements, beyond the one-dimensional line defined by “market” and “hierarchy”, that can facilitate the processes of integrative coordination, and collective creation in organizations.

The dissertation is composed of three essays. Essay 1 is a theory paper that provides the overall theoretical arguments about why transaction cost economics (Williamson 1979, 1991, 1996, 2002) is no longer a satisfactory theoretical framework for governance design in the digital age, and offers a normative model which suggests possibilities of much more nuanced, complicated and pluralistic governance choices than suggested by transaction cost economics. It is argued that potential governance choices are not solely situated on a one-dimensional line between hierarchy and market, as transaction cost economics asserts. The rich connotations of socially constructed agency (Giddens, 1985; Greenwood et al. 2011) provide diverse possibilities of governance arrangements, which spread across a triangular plane in a three-dimensional space defined by static efficiency, coordinative efficiency and creative efficiency (see Figure 1). This paper provides both graphic and mathematical presentations of this three-dimensional model for governance design, which can be applied to different levels of organizing.

Essay 2 and 3 are two empirical papers that endeavor to extend Essay 1 by finding out the exact relationship between certain innovative governance arrangements with organizations’ performance in coordinative and creative efficiencies. Essay 2 focuses on the realization of integrative coordination in organizations. It found out that layered distributed organizational structure (Simon, 1962), broad-brushed *ex ante* plan (Edmondson, Bohmer and Pisano, 2001), and semi-structures (Brown and Eisenhardt, 1997) are beneficial in facilitating an ongoing

coordination process when interdependencies are complex and uncertain. Essay 3 focuses on organizations' performance in collective creativity (Shalley et al., 2004; George, 2007), especially on what governance arrangements can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency. It is discovered that “ordered disruption”, including ordered spatial disruption, ordered temporal disruption and ordered affective disruption, have positive effects on the emergence of collective creativity. Both Essay 2 and Essay 3 use collaborative organizations on smart city projects as the empirical setting. The findings of these two empirical papers are grounded on multiple case studies on those collaborative organizations.

Figure 1: Three essays on governance designs



- **Essay 1 (theoretical):**
 - Theory paper that offers a normative model which suggests possibilities of much more nuanced, complicated and pluralistic governance choices
- **Essay 2 (empirical):**
 - What organizational features can facilitate an ongoing coordination process when interdependencies are complex and uncertain.
- **Essay 3 (empirical):**
 - What organizational arrangements can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency

The dissertation advances literature on governance design by breaking the one-dimensional emphasis on static efficiency as the sole purpose of economic activities, and bringing in a more dynamic, diverse, and multi-dimensional view that fits better the changing nature of organizing and governance in digital age. It brings in evolutionary theories and complexity theory into the studies of organizational governance and makes important discoveries about innovative governance arrangements that facilitate organizational processes capable of reconciling the tensions among efficient, coordinative and creative purposes of organizing.

In the remainder of this introduction, I first explain why it is important to revisit theories on organizational governance. Then, I provide arguments on why the rise of digital economy changes the nature of organizing and governance, especially on why it makes organizations' role in facilitating integrative coordination and collective creation more salient. Finally, I would explain the choice of collaborative organizations on smart city projects as the empirical setting, and the choice of multiple-case studies as the research method for Essay 2 and 3.

Limitations of Transaction Cost Economics

My enthusiasm on organizational governance came from a general dissatisfaction on the current monopolistic position of transaction cost economics in this area. To my observation, at least three basic assumptions of transaction cost economics can be challenged thus make the explanatory power of this theory rather weak.

First, in transaction cost economics, economic agents are assumed to be self-centered and opportunistic (Williamson, 1991). Thus, the key function of governance is reduced to the controlling of the risk of opportunistic behaviors and appropriation in face of uncertainty.

However, researchers in social and evolutionary psychology have long proved that human beings can behave in altruistic, cooperative, and noneconomic ways. Even if we assume all human actors are self-centered with an exclusive drive of maximizing their own economic interests, as the process of realizing such self-interest maximization is embedded in complex relational and social nets, the behaviors of human actors are inevitably affected by non-economic factors that are defined by relational and social capitals, non-economic institutional contexts, and reciprocal obligations (Poppo and Zenger, 2002; Johnston et al., 2010).

Secondly, transaction cost economics, as most of neo-classical economic theories, tends to assume that market is the most efficient institution for hosting economic activities (Hayek, 1945; Williamson, 1981). In contrast, organizations are mere institutions that complement market in situations of market failures. In other words, the purpose of organizing is about ensuring value appropriation, and the role of organization in value creation has been largely ignored (North, 1990). However, as Moran and Ghoshal (1999) pointed out, there are two categories of resource deployments: exchanges and combinations. Market is a powerful institution that enables bilateral exchanges thus facilitates efficient resource allocation. But the key of value creation lies in the different ways of choosing the set of resources and pressing them into goods and services with appropriate processes that often require collective efforts. Such process is called a combination (Moran and Ghoshal, 1999). Moran and Ghoshal (1999) synthesized three conditions for any resource combination to occur in an economic world. First, all necessary resources to execute this combination have to be in place. Second, the execution of this combination has to be motivated. Third, the goods or services produced by this combination have to be considered valuable. Both market and organizations are necessary for the fulfillment of these three conditions. While markets are efficient in resource allocation, organizations are the

institution that amass those resources and put them into coordinated use. While market motivates economic activities by enabling bilateral exchanges, organizations provide unique institutional contexts that motivate activities for collective goals. Apparently, both market and organizations are indispensable institutions for value creation and both value appropriation goal and value creation goal of organizing should be respected.

Last but not the least, transaction cost economics concerns itself with only static efficiency, that is, how to optimize the allocation of a given level of resources with a given degree of specialization at a given point in time. This point of view is seriously limited. Not only the pool of resources and the scarcity of resources can change over time, organizational strategy is all about surviving a dynamic process of competition. In the literature of strategic management, the stream of research that emphasizes adaptation and the value creation with changing environments is surging (Teece, Pisano, and Shuen, 1997; Galunic and Eisenhardt, 2001). Although static efficiency is still important, firms' competitive advantage depends more and more on integrative capabilities and creativity. As stated in the previous paragraph, organizations are indispensable institutions to search for new combinations of resources (creative efficiency), and execute collective processes that integrate those resources into valuable services and goods (coordinative efficiency). Governance structure, as the overall framework that "gives organizations their authority and mandate for action" (McGahan, 2014), plays a key role in enabling organizational actors to exercise their agency in creating valuable combinations and allow the organizations to capture those created values with the highest probability. This is exactly the essence of what Schumpeter called "creative destruction" (Schumpeter, 1934; 1947). Consistent with North's (2010) notion of adaptive efficiency, coordinative and creative efficiency shows recognition to evolutionary process and diversity of contexts. Organizations are

no longer treated as the last resorts to handle market failures, but entities that can combine resources to create new values and resources. Stretching the understandings about efficiency from static to a more evolutionary basis significantly expands the theoretical possibilities to explain the diversity of organizational forms and governance structure.

The thesis argues that governance designs that can survive fierce competition and rapidly changing environment are those, which take all these three dimensions into consideration. This is true in all ages. However, the rise and wide application of digital technologies have made this more salient and pertinent.

The Impact of Digital Age on Organizations

Human history is witnessing a Third Industrial Revolution, the Digital Revolution. Internet, and endless innovations based on information and communication technology (ICT) is profoundly transforming human interactions, productive processes, and urban lives. The rapid surge of data storage and processing capabilities opens up revolutionarily new space for utilizing data. Such changes are not just pertinent to ICT-based firms and industries. They are transforming our lives and economic activities in general. As Mayer-Schönberger (2013: 5) mentioned in his book “Big Data: a revolution that will transform how we live, work and think”, “Data was no longer regarded as static or stale, whose usefulness was finished once the purpose for which it was collected was achieved... Rather, data became a raw material of business, a vital economic input, used to create a new form of economic value. In fact, with the right mindset, data can be cleverly reused to become a foundation of innovation and new services. The data can reveal secrets to those with the humility, the willingness and the tools to listen”. In other words, data and data analytics are no longer solely used to optimize operational processes, improving

efficiency, or assist strategic choices. In the digital age, data mining can lead directly to products and services. eHarmony, for example, is an internet-based service that use big data to help clients find their perfectly matching significant other. Bing Travel, using massive data obtained from flight reservation databases, offers its customers a tool to purchase plane tickets with the best chances of having the lowest prices. Data obtained from new sources, such as social media, mobile apps, human and industrial sensors, are also opening up new opportunities. More and more, municipalities are working with firms in energy, electronics, real estate, transportation and waste procurement to explore new solutions for urban life, based on sensor data that reveal citizens' behaviors. Thanks to fine sensor data and innovative data analytics, projects, such as IssyGrid in France, is able to make considerable savings on energy with smarter energy production and distribution.

While discussions and research on digital technologies is numerous, a question not yet sufficiently addressed is: Will the uses of digital technologies reshape organizations, and how? This thesis is based on a positive answer to the above question. It is my belief that digital technologies are drastically changing organizational lives. As a result, organizational and managerial theories should follow suit. My reasons are as following.

First, a vast body of economic research, especially neoclassical economics, is based on marginal analyses of a competitive market-based pricing system. Market, in perfect competition, is considered as an efficient institution for resource allocation. This is what Adam Smith's famous metaphor—"invisible hand"—refers to. Data, however, is a typical non-rivalrous (or non-subtractive) good. That is to say, the use of data by one does not decrease the availability of the same data by another (Samuelson 1954; Ostrom and Ostrom 1977; Ostrom 2006; Sandler 1986, 1992). In economic terms, non-rivalry means that the marginal cost of providing this resource to

an additional user is zero (Samuelson, 1954; Sandler, 1986). Such characteristic puts market's role in efficient resource allocation into question as the marginal cost of this resource can no longer equal the marginal revenue gained from the exchange of it (Bates, 1985). What is more, when rivalrous resources are traded in a competitive market, the market equilibrium is also the optimal allocation of those resources in social welfare term ("The First Fundamental Theorem of Welfare Economics"). Yet for data, an extremely non-rivalrous resource, the optimal allocation can only be achieved when it is provided to the public with free access and zero prices. The reasoning is straightforward. When the resource is non-rivalrous and the costs of reproduction and transfer are zero, any individual or firm that can make a positive outcome out of this resource should have access to it, so that the total social output can be improved. Thanks to the non-rivalrous nature of data as a resource, open and free access to data would not cause "the Tragedy of the Commons" (Hardin 1968, 1994). Unlike Hardin's grazing lands, increasing number of users to data would not increase the risk of depletion, but solely increase the possibility of unearthing more values out of it.

However, data is not naturally a public good in the sense that it is excludable. That is to say it is possible to prevent individuals or firms from accessing data if they did not pay for it (Samuelson 1954: 387-389). Most of the data, especially "big data", are not intentionally produced. They are somewhat "by-products" of natural, human, or industrial activities. Nevertheless, certain platforms, such as Facebook, Google, etc., are better positioned in collecting data and keep it proprietary. Thus, these holders of data are monopolists to some extent. They have the incentive to keep such monopolistic rights as the exclusion of other users to data can potentially give the data holders a competitive advantage vis-à-vis its competitors. Facebook, for example, provides services in targeted advertising better than many of its

competitors largely thanks to its possession and analytics of massive data generated by its users' activities. However, such monopolistic rights are both difficult and socially value-destructive to maintain. As data can be reproduced and transferred with next to zero cost, monopoly will be lost as soon as the holders start to exchange data in an open market. More importantly, the value of data is not defined ex-ante, but has to be creatively explored and exploited by analysts. Any private ownership of data is destroying value for the society as it prohibits other individuals and firms from releasing data's value from innovative angles.

Second, data as a resource accentuates the importance of creativity in an organization, because data itself is only a raw material. Creative efforts are what turn data into valuable information (Drucker 1998). Such creativity stems from both the realization of individual autonomy and human agency, and the realization of collective creative processes in organizations. Human agency is defined as actors' capabilities of making a difference in social conduct (Giddens, 1985). Data-driven economy depends on specialized knowledge and creativity in mining the data and innovatively applying the findings. Such discoveries cannot be made, or directed, solely at corporate headquarters but have to be carried out by specialists (and teams of specialists) at all levels of organizations. In today's organizations, human agency is not just an aberrant factor that needs to be controlled, but becomes the primary source of competitive advantages when managed properly. A further question is: If human agency is what needed for realizing values hidden in data, why are organizations needed in this creative process? While individual insights are undeniably important as sources of creativity, with the rise of the applications of information technology, and the corresponding increase in the complexity of the problems human beings can and want to tackle. It is becoming increasingly rare for any individual to possess the necessary knowledge, expertise, skills, or the insights, to be able to

creatively solve those complex problems alone. The accomplishment of such complex tasks requires knowledge and expertise from a variety of disciplines and perspectives (Bissola and Imperatori, 2011). As creative insights often come from the confluence of existing ideas (Hargadon and Bechky, 2006), creativity increasingly comes from collective efforts. Although related, individual creativity and collective creativity are two distinct phenomena. Collective creativity is not the aggregate creativity of all organizational members (Taggar, 2002). It comes from “mindful interactions of participants in the problem-solving process” (Hargadon and Bechky, 2006: 487), and deserves attention from management scholars. In fact, digital technologies are accelerating changes in each and every aspect of business world. In order to stay competitive, firms have to exhibit high levels of both individual and collective creativity.

Last but not the least, digital technologies are altering the ways of coordination in our society. Not only digital technologies significantly reduce the cost of communications and a variety of transactions, their wide applications require and enable work of ever-higher degrees of complexity and uncertainty in task interdependency. As the logic of production shifted from engineering to information, work becomes increasingly knowledge-based and creative in nature. Single best solutions did not exist anymore, and processes towards completion became difficult to estimate (Kraut & Streeter, 1995). The interdisciplinary tasks require the collaboration among various specialists, and the nature of work is increasingly ambiguous, unpredictable and hard to measure. Furthermore, recent developments in technologies make it possible to integrate tasks, organizations, and industries that were not usually integrated before, in order to obtain larger social purposes. Transactions and collaborations across boundaries, either the boundaries among business units, organizations, industries, or countries, have become common, thanks to better-standardized interfaces and more means of telecommunication (Siggelkow and Rivkin, 2005).

Take urban solutions for example, thanks to big data analytics and advanced development in ICTs, municipalities nowadays can attempt to tackle disparate aspects of urban life, such as energy, water, waste, transportation, with better coordinated solutions. By integrating data and information from various aspects into a shared platform, cities can be more efficient, convenient, agreeable, environmental friendly and inclusive. In one word, they can be “smarter”. Those “smart city” projects, however, are with ambitiously large scale that is infeasible to accomplish by one single organization alone. The blurring boundaries raised challenges to the applicability and effectiveness of certain widespread integrative coordination mechanisms, foremost formal hierarchy. In her empirical work, for example, Metiu (2006) showed that installing formal mechanisms indicating status difference across units can harm the sense of autonomy of participating groups, thus cause coordination breakdowns.

All the observations listed above indicate that it is more and more difficult to do business as usual in digital age. Notably, governance is no longer solely about control. The design of organizational governance needs to allow and incentivize spontaneous and creative endeavors from all organizational members. Organizational process can no longer be linear and clear-cut, but likely to be fuzzier and more experimental. Organizational members are inspired by a common strategic orientation, however, results and products are not fully defined *ex-ante*, but rather let emerge during the process. The above analyses indicate the importance of integrative coordination process and collective creative process. They correspond with the axes of “coordinative efficiency” and “creative efficiency” in the model raised in Essay 1 and are going to be the subjects addressed by Essay 2 and 3 respectively.

Why Collaborative Organizations on Smart City Projects?

We took smart city projects as our empirical setting because they represented a typical setting for both integrative coordination challenge and collective creativity challenge in the digital age. A city, or a district of a city, is considered “smart” when solutions for disparate aspects of urban life, such as energy, water, waste treatment, transportation, are tackled as an interactive system enabled by big data analytics and ICTs (Information and Communication Technologies). By integrating data and information from various aspects into a shared platform, cities can be more efficient, convenient, agreeable, environmental friendly and inclusive. In short, they can be “smarter”.

Surrounding smart cities, a new industry is burgeoning. Public agencies and private firms alike are searching actively new solutions to improve urban life. This brand new industry requires not only the development of related new technologies, but also knowledge about innovative business models for its organization and financing. As the realization of such a large-scale systemic task depends on a wide diversity of expertise, the development of smart cities is really a massive collective creation process, thus makes this industry a perfect setting for studying collective creativity.

What is more, the construction of a smart city is a large-scale systemic project. The process of constructing them is typically representative of integrative coordination in systemic projects enabled by information and communication technologies. The ambitiously large scales of smart city projects means they have to be carried out by multiple players from a diverse range of industries, which may or may not traditionally work together. As the work carried out are often close to the technical cores of respective groups, the boundaries among participating parties are blurry. The successful enforcement of smart city projects commands strong collective actions of all parties in order to fulfill highly interdependent tasks. Moreover, as the projects often

involve creative work, it is difficult to define all tasks ex-ante and progress towards completion is difficult to estimate (Kraut & Streeter, 1995). All these features mentioned above made integrative coordination in such projects especially pertinent yet difficult to achieve and maintain. Thus, smart city projects provide a perfect empirical setting to study the integrative coordination as well.

As smart city industry is extremely new, it was indeed very difficult to find the appropriate cases. I had to look into and make preliminary interviews on a large number of projects before choosing the appropriate and comparable cases for the studies. Fortunately, I had the help from Digital City Engineering Research Center of the Ministry of Housing and Urban-Rural Development of China and the Global Advisory Committee of the Smart City Expo for locating the right cases. Eventually, six cases were chosen for Essay 2 and four cases were chosen for Essay 3.

Why Multiple-Case Study as the Research Method?

In 2007, Edmondson and McManus published an important paper in *Academy of Management Review*, titled: “Methodological Fit in Management Field Research”. This is a paper that provides a guiding framework for finding the proper methodology for field research. This paper argues that the right choice of methodology for field research, i.e., research that relies on the collection of original data, either qualitative or quantitative, depends on the maturity of existent theories on the research subject. When the research subject is based on mature theories, then, quantitative research methods are more appropriate, because mature theories already offer well-defined models, and the main purpose of research on those theories is about validation and

refinements. Nascent theories, i.e. research areas that are not sufficiently addressed previously, however, require qualitative research because the openness of qualitative data allows researchers to explore diverse possibilities and discover new and powerful theories. This process is often called a grounded theory approach.

Although governance design is not a new research subject, however, the rise of digital era is dramatically changing the nature of governance and organization. Under the circumstances, this thesis attempts to break through mainstream theories on governance and the research questions addressed in this thesis are not yet sufficiently addresses. For those reasons, the two empirical essays. i.e., Essay 2 &3, both take a grounded approach and apply qualitative research method.

One of the most widely applied qualitative research methods is case study. This research method is very powerful in theory developing (Eisenhardt, 1989a; Eisenhardt and Graebner, 2007), as it allows the examination of rich data and real-world contexts. Compared to single case study, multiple-case study has a strong advantage, that is, the replication logic (Yin, 1984; Eisenhardt, 1989b). Multiple cases give researchers a chance to recycle data across cases and examine the validity of a finding by comparing cases. As a result, multiple-case study can lead to more solid discoveries and possess a strong ground for emerging theories. For all those reasons mentioned above, this thesis chose multiple-case study as its research methodology.

CHAPTER 2:

Multi-dimensional Space for Governance Design in Digital Age

ABSTRACT

The aim of this paper is to provide a theoretical framework to better guide governance design in digital age. It is argued that mainstream theories on governance design, most notably transaction cost economics, overemphasize the importance of value appropriation and static efficiency (Coase, 1988; Williamson, 1991), while overlook the importance of value creation (Dekker, 2004; Lepek et al., 2007) and evolutionary efficiency (Nelson and Winter, 1982; North, 2010). This paper points out that potential governance choices are not solely situated on a two-dimensional line between hierarchy and market, as Williamson asserted (Williamson 1979, 1991, 1996, 2002), they can be spread across a triangular plane in a three-dimensional space defined by static efficiency, coordinative efficiency and creative efficiency. We argue that this three-dimensional model is more suitable than transaction cost economics in guiding governance design in digital age. Both a graphic and mathematical presentation of this model is provided in this paper, which can be applied to different levels of organizing.

Keywords:

Governance design, value creation, static efficiency, coordinative efficiency, creative efficiency, participative community

Human history is witnessing a Third Industrial Revolution, the Digital Revolution. Internet, and endless innovations based on information and communication technology (ICT) is profoundly transforming human interactions, productive processes, and urban lives. While discussions and research on this new wave of technological transformation is numerous, what has been relatively less examined is how such technological change reshapes the organization of economic activities. Would the rise of the digital age shake basic assumptions of economic and managerial theories? If so, what theoretical framework we should refer to when searching the governance modes that enable firms (may or may not be in the forms we know them with) better meet the challenges and opportunities a digital era provides?

The aim of this paper is to provide a theoretical framework to better guide governance design in digital age. It is argued that mainstream theories on governance design, most notably transaction cost economics, overemphasize the importance of value appropriation and static efficiency (Coase, 1988; Williamson, 1991), while overlook the importance of value creation (Dekker, 2004; Lepek et al., 2007) and evolutionary efficiency (Nelson and Winter, 1982; North, 1994). With the rise of information and communication technologies, such lack become increasingly pronounced, as transaction costs for information exchanges dramatically drop and the need for rapid adaptation to environmental changes surges in the meantime. This paper points out that potential governance choices are not solely situated on a two-dimensional line between hierarchy and market, as Williamson asserted (Williamson 1979, 1991, 1996, 2002), they can be spread across a triangular plane in a three-dimensional space defined by static efficiency, coordinative

efficiency and creative efficiency. We argue that this three-dimensional model is more suitable than transaction cost economics in guiding governance design in digital age. Both a graphic and mathematical presentation of this model is provided in this paper, which can be applied to different levels of organizing.

The Rise of Digital Age Revisits Basic Assumptions of Transaction Cost Economics

A Brief Review of Transaction Cost Economics

The most prevailing and influential theory in explaining the choice of governance structures is transaction cost economics (Coase, 1960, 1988; Williamson, 1985, 1991, 1996, 2002). Transaction cost economics is constructed upon the assumption that organizational members are always tempted by opportunism in order to appropriate maximum benefits. In order to control opportunistic behaviors, proper governance mode is required. Transaction cost economics proposes that governance can take one of the following forms: market, hierarchy or a hybrid. The overriding purpose of choosing the most appropriate governance mode is efficiency. To be more specific, it is about minimizing transaction costs, while curbing the risk of opportunistic behaviors and appropriation in face of uncertainty.

Transactions cost economists identify three characteristics of tasks undertaken by organizations, asset specificity, uncertainty and frequency, as the key factors deciding governance mode. Asset specificity occurs when the asset dedicated to a certain task can hardly be used in alternative tasks (Geyskens et al., 2006). There are different forms of asset specificity: location specificity, physical asset specificity, human asset specificity, brand name or reputational capital, and dedicated capacity (Williamson, 1991; Nooteboom, 2004). When asset

specificity is high, the investor of this asset becomes more dependent on the collaborative projects, hence allow the other parties to engage in opportunistic behaviors. In order to hedge those risks, partners who invest into specified assets tend to prefer hierarchical governance structures and formal control mechanisms. Uncertainty refers to the unpredictability of future changes. High uncertainty creates difficulties in designing complete ex-ante contracts. With bounded rationality and foresight, collaboration can only rely to incomplete contracts, which leave rooms for opportunistic behaviors in the future (Das and Teng, 2001). As a result, under uncertain conditions, partners have stronger preference for hierarchical governance structure, so that they can use fiat instead of contracts to control, coordinate and monitor behaviors.

Transaction frequency is also directly linked with transaction costs and governance choice. The reason is apparent. Drafting, implementing and monitoring each and every transaction produce certain costs. The more frequent the transactions are, the more times those costs occur. Thus, high frequency of transaction indicates high transaction costs. In order to minimize transaction cost and make economic activities more efficient, transaction cost economists suggest hierarchical governance structure over market when transaction frequency is high (Geysken et al., 2006).

To sum up, the logical basis of transaction cost economics in explaining the choice of governance lies on avoidance of opportunistic behaviors. Asset specificity, uncertainty and frequency of transactions all increase the costs of opportunistic behaviors that are difficult to control by ex-ante contracts, thus makes hierarchical governance structure more favorable. The choices of governance are limited to contractual control and hierarchical control. Although Williamson (1991) acknowledged a third governance mode—hybrid, it is merely a mixture of market and hierarchy. In other words, hybrid is just a compromise. It sacrifices some of the

economic incentives of the market in favor of effective coordination and some efficiency of the hierarchy in favor of superior market incentives (Gulati, 1995; Dekker, 2004). The determinant on the proportion of market or hierarchical elements is still the risks of opportunistic behaviors due to asset specificity, uncertainty and frequency of transactions. Higher the risk is, stronger the preference for hierarchical governance will be. However, exact how such mixture can be made has never been explicitly explained by transaction cost economists (Pache and Santos, 2013).

Revisit the Concept of Governance

Every social theory is based on a specific set of assumptions about human psychology. With transaction cost economics, actors are assumed to be self-centered and opportunistic. The guiding principle of their actions is the maximization of their own economic interests. Thus, the key function of governance, according to this theoretical approach, is about controlling the risk of opportunistic behaviors and appropriation in face of uncertainty. Stemming from this basis, transaction cost economics argues that organizations adopt one of the following modes of governance – market, hybrid, or hierarchy – according to asset specificity, uncertainty and frequency of the transactions (Williamson, 1991).

However, transaction cost theorists' assumption about human actors is a particularly narrow one. Researchers in social and evolutionary psychology have long proved that human beings can behave altruistic, cooperative, and noneconomic, thanks to our long evolutionary

history and group memories (Gintis, 2000; Gintis et al., 2003; Rose-Ackerman, 1996). Even if we assume all human actors are self-centered with an exclusive drive of maximizing their own economic interests, as the process of realizing such self-interest maximization is embedded in complex relational and social nets, the behaviors of human actors are inevitably affected by non-economic factors that are defined by relational and social capitals, non-economic institutional contexts, and reciprocal obligations (Poppo and Zenger, 2002; Johnston et al., 2010).

Situated on the highest level of organizing, governance is an art balancing structure and agency. A more accurate understanding of governance demands more holistic understanding of human agents. Governance is not only about structure, and even if it is, this is a structure based on how we understand agency and how we expect to shape and guide human behaviors within that structure. Governance is not only about control. It is about facilitating actions with structure. It is about drawing a box so that actors can think out of the box. In fact, Giddens has long pointed out that in modern society, organizations are unlikely to achieve complete control (Giddens 1985: 186). Such observation is especially true in digital age, where structural properties are diverse (Whittington, 1992). Actors are left with unprecedentedly more freedom in making choices and making differences. As a matter of fact, they are expected to.

The rapid surge of data storage and processing capabilities opens up revolutionarily new space for utilizing data. As Mayer-Schönberger (2013: 5) mentioned in his book “Big Data: a revolution that will transform how we live, work and think”, “Data was no longer regarded as static or stale, whose usefulness was finished once the purpose for which it was collected was achieved... Rather, data became a raw material of business, a vital economic input, used to create a new form of economic value. In fact, with the right mindset, data can be cleverly reused to

become a foundation of innovation and new services. The data can reveal secrets to those with the humility, the willingness and the tools to listen”.

Data as a productive resource accentuates the importance of individual autonomy and human agency in an organization. Human agency is defined as actors’ capabilities of making a difference in social conduct (Giddens, 1985). Digital economy depends on specialized knowledge and creativity in mining the data and innovatively applying the findings. Such discoveries cannot be made, or directed, solely at corporate headquarters but have to be carried out by specialists (and teams of specialists) at all levels of organizations. In today’s organizations, human agency is not just an aberrant factor that needs to be controlled, but becomes the primary source of competitive advantages, when managed properly. Moreover, availability of large amount of data (big or small) and the advancement in data analytics accelerates changes in each and every aspect of business world. In order to stay competitive, firms have to detect, react, and adapt to new trends as fast as possible. Such sensitivity and agility can only be developed when human agency of organizational members is fully realized.

The concept of agency cannot be stripped to the tendency of behaving opportunistically. Agency is the ability of individuals to make a difference. That difference can be opportunistic, self-centered, and it can be altruistic, cooperative and innovative. Under such circumstances, it is seriously out of date to consider “control” as the primary function of governance and to base governance design on overly simplistic and one-dimensional assumptions about human nature. Although many researchers in institutional research have noticed the limit of neo-economic theories in explaining agentive behaviors (Hirsch 1997; Greenwood et al. 2011), academic discussions to date stay mainly on the field level (Dunn and Jones, 2010; Reay and Hinings, 2009; Schneiberg and Clemens, 2006). However, on organizational level, what is the relationship

between organizational governance and the agentive behaviors of organizational members? Is structure necessarily against agency and innovation? What are the roles of relational and social capital in encouraging or stifling agentive behaviors in organizations? More research is needed to provide insights into these questions.

Revisit the Purpose of Organizing

A prevailing assumption in mainstream economics, including transaction cost economics, is that market is the most efficient institution for resource allocation. As far as market force is respected, the invisible hand will put resources into the best uses, thus realize the maximal level of value creation (Hayek, 1945; Williamson, 1981). The shadow side of this assumption is that organizations, no matter what form they are with, are deprived of any independent role in the creation of value (North, 1990). From the perspective of transaction cost economics, the *raison d'être* of firms is to diminish transaction costs of bilateral exchanges when uncertainty or unpredictability is too high. In other words, organizations are mere tools to deal with market failures. The purpose of organizing is about ensuring value appropriation. The role of organization in value creation, however, has been largely ignored.

Indeed, in order to create value, one needs to make the best use of resources (Penrose, 1959), and market exchange is an important tool to gather all necessary resources for productive activity. However, as Moran and Ghoshal (1999) pointed out, there are two categories of resource deployments: exchanges and combinations. In a sense, we can understand combinations as the productive methods. Just by putting all resources together does not produce anything. The

key of value creation lies in the different ways of choosing the set of resources and presses them into goods and services. Such process is called a combination (Moran and Ghoshal, 1999). Combinations do not just show themselves. It requires the work and creativity of economic agents, oftentimes organized economic agents. When the new combinations replace old combinations to produce goods and services with higher values with the same resource pool, a process of value creation occurs. In other words, exchange do enhance the chance of value creation by making necessary resources available, however, value creation happens with the creative endeavors of economic agents, either individuals or organizations, in finding new combinations that provide more potential values.

With the increase of resources diversity, the possibilities of new combinations rise at a combinational rate (Moran and Ghoshal, 1999, c.f. Weitzman, 1996). Resultantly, the importance of discovering those new combinations for value creation rises as well.

The increasing importance of creative combinations for value creation becomes even more salient with the rise of data as a key economic resource. Data, big or small, is a typical non-rivalrous (or non-subtractive) good. That is to say, the use of data by one does not decrease the availability of the same data by another (Samuelson 1954; Ostrom and Ostrom 1977; Ostrom 2006; Sandler 1986, 1992). In economic terms, non-rivalry means that the marginal cost of providing this resource to an additional user is zero (Samuelson, 1954; Sandler, 1986). Such characteristic puts market's role in efficient resource allocation into question as the marginal cost of this resource can no longer equal the marginal revenue gained from the exchange of it (Bates, 1985).

What is more, when rivalrous resources are traded in a competitive market, the market

equilibrium is also the optimal allocation of those resources in social welfare term (“The First Fundamental Theorem of Welfare Economics”). Yet for data, an extremely non-rivalrous resource, the optimal allocation can only be achieved when it is provided to the public with free access and zero prices. The reasoning is straightforward. When the resource is non-rivalrous and the costs of reproduction and transfer are zero, any individual or firm that can make a positive outcome out of this resource should have access to it, so that the total social output can be improved. Thanks to the non-rivalrous nature of data as a resource, open and free access to data would not cause “the Tragedy of the Commons” (Hardin 1968, 1994). In fact, the value of data cannot be defined *ex-ante*, but has to be creatively explored and exploited by analysts. Thus, unlike Hardin’s grazing lands, increasing number of users to data would not increase the risk of depletion, but solely increase the possibility of unearthing more values out of it, or in other words, finding more new combinations.

A further question would be: even if allocative efficiency concerns and marginal analyses recede to a secondary position in a data-driven economy, would not market, compared to organizations, serve as a better institution to promote discoveries and innovations, as the decentralized and individualized agents increases the scope of search? Yes and no. Both market and organizations are needed to maximize value creation from given resource endowments.

Moran and Ghoshal (1999) synthesized three conditions for any resource combination to occur in an economic world. First, all necessary resources to execute this combination have to be in place. Second, the execution of this combination has to be motivated. Third, the goods or services produced by this combination have to be considered valuable. If market is the only organizing principle, as far as a combination is not perceived as valuable in the bilateral exchange, this combination will not be motivated. In this case, the value creation potential of the

whole economy is severely constrained. Organizations can create unique institutional contexts that motivate combinations even if those combinations do not benefit organizational members directly. In other words, organizations can serve coordinative roles that enable behaviors that would not occur solely with market, thus induce combinations that would otherwise be unviable. This coordinative role of organizations in value creation is especially important when combinations require complex and interdependent processes, which are pervasive in modern economy, especially in digital economy.

Digital economy simultaneously deepens the degree of specialization and widens the scope of collaboration. Data itself is only a raw material. Specialized knowledge is what turns data into valuable information (Drucker 1998). Besides, the data-driven business world is becoming increasingly fluid and disruptive. More and more, we observe firms working on very focused domains and cultivate strong expertise in specialized areas to remain competitive. Thus, the rise of data as a key resource of production not only requires more specialists, especially on the operational floor, but also deepens the degree of specialization.

At the same time, data and related digital technologies make it possible for human race to tackle more complex tasks, and tasks with larger scales. Take urban solutions for example, thanks to big data analytics and advanced development in ICTs, municipalities nowadays can attempt to tackle disparate aspects of urban life, such as energy, water, waste, transportation, with better coordinated solutions. By integrating data and information from various aspects into a shared platform, cities can be more efficient, convenient, agreeable, environmental friendly and inclusive. In one word, they can be “smarter”. Those “smart city” projects, however, are with ambitiously large scale that is infeasible to accomplish by one single organization alone.

The simultaneous development in deepened specialization and increased complexity/scale of task naturally accentuate the importance of coordination and collaboration. It is high time for economic and managerial researchers to pay more attention to organizations' coordinative and creative role in executing new combinations and facilitating value creation.

Some scholars have already started to reflect on the one-sided emphasis on value appropriation as the main goal of organizing (Osborn and Baughn, 1990; Porter, 1996; Teece et al., 1997; Galunic and Eisenhardt, 2001). From a resource-based theory perspective, Das and Teng (2000) emphasized that the rationale for organizing is the value-creation potential of firm resources that are pooled together. In other words, economic agents organize themselves for gains that they cannot achieve individually. It is the integrated efforts for value creation that draws them together. Dekker (2004) identified interdependence as a powerful explanatory factor on governance choice. He argues that there are two types of organizing problems. One type deals with appropriation concerns. This type has been widely examined in existing literature, especially in the stream of transaction cost economics. The other type deals with coordination requirements. The level of coordination requirements depends on the level of interdependence. Borrowing the categorization methods from Thompson (1967), he suggested three categories of interdependence: pooled, sequential and reciprocal. With pooled interdependence requires the lowest level of coordination and reciprocal interdependence requires the most complex coordination mechanisms for communication and ongoing adjustment to each other's situation (Boroy & Jemison, 1989).

Nevertheless, literature in economic and organizational analyses that tackles the goal of collective value creation is still limited. Even less examines how governance structure and mechanisms should be designed with value creation as the guiding principle. It is important to

stress again that the connotation of governance and control is not confined to containing the danger of opportunistic behaviors, but to structure in order to motivate, coordinate and facilitate jointed efforts to achieve outcomes that cannot be achieved without integrated efforts. One-sided emphasis on minimization of transaction cost and value appropriation concern led researchers to neglect a large number of potentially powerful constructs for governance choices and organizational structure. Market exchanges are crucial processes that facilitate resource mobility, thus enable the pooling of necessary resources. However, it is the combinational processes that directly create values. Organizations strongly influence such combinational processes by motivating coordinated efforts and empowering collective creation of new combinational methods. Researchers need to broaden understandings about goals of organization from value appropriation only to include value creation as well. More research is critically called for to understand what organizational and governance structures and processes can best promote the creative combinations that involve the coordinated efforts.

Revisit the Concept of Efficiency

After we identified both resource allocation and resource combination as two interactive processes to create value, it is apparent that the concept of efficiency itself should be revisited as well. Under the influence of neo-classical economics, transaction cost economics and a large literature on governance presume “static efficiency”, i.e. how to optimize the allocation of a given level of resources with a given degree of specialization at a given point of time, as the supreme goal of organizing. However, when combination is taken into consideration, this

definition of efficiency is deficient for at least two reasons.

First, “static efficiency” overly emphasizes marginal analysis, i.e. resource allocation with a given degree of scarcity. This is of course appropriate in equilibrium analysis that excludes any contexts and the process of evolution. However, for combinational activities that occur with contexts, confine efficiency to a static state is problematic. The founding father of modern economic theories, Adam Smith (1776), made two important observations. One, market is an efficient institution in resource allocation; and the other, division of labor and specialization is a drive of productivity gain. However, with time, mainstream economic research overwhelmingly focuses on the former aspect while take the latter as a given. Neo-classical economists examine carefully how to increase allocative efficiency and enhance productivity with economy of scale, yet what is less examined are gains that can be made with correct divisions of labor and better coordination among agents with specialized skills. In other words, crucial business decisions about what economic activities to engage in, and whether or not to engage in an activity (Yang, 2003) are excluded from theoretical considerations. Yang (2003) synthesized those as infra-marginal choices. However, such choices are extremely pertinent with digital economy. As pointed out in previous text, data-driven economy and ICT technologies have fundamentally altered the divisions of labor and the network size of the divisions of labor. On one hand, the increasingly competitive and disruptive market landscape and strong requirements for specialized knowledge and skills force firms to retreat to specialized domains, even if economy of scale exists; on the other hand, data and ICTs make it possible for human race to tackle more complex tasks, and tasks with larger scales. The tension between the deepening degree of labor divisions and the enlarged network size of labor divisions makes the choice of “make or buy” not solely a decision based on the features of transaction, but also on

firms' market positions, organizational capabilities and the task complexity they aim to achieve. Even if the interests of all actors are perfectly aligned, different divisions of labor still need to coordinate effectively to complete the overall task. The coordinative efficiency pays attention to the relationship between structure and process (Gulati et al. 2012). In the past decade, we witness exponentially increased interactions both intra-organizationally (with the development of matrix- or network-formed organizations) and inter-organizationally (with the surge of strategic partnerships in various forms). Governance design needs to look outside of static efficiency and put more attention to “coordinative efficiency”, which is productivity gained from better integration among interdependent actions.

The second limitation about basing governance design entirely on static efficiency is precisely the under-examination of the dynamic process. On one hand, the pool of resource at a given moment of time is fixed, however, with an expanded period of time, the scarcity of resources can be altered. Such changes are not only due to exogenous factors, such as discoveries of new resources or groundbreaking technological improvement, but also due to endogenous factors such as the accumulation of knowledge, skills and innovative endeavors of agents. On the other hand, even if resource endowments do not alter, creative combinations can produce goods and services with completely different values (Penrose, 1959). Governance structure, as the overall framework that “gives organizations their authority and mandate for action” (McGahan, 2014), plays a key role in enabling organizational actors to exercise their agency in creating valuable combinations and allow the organizations to capture those created values with the highest probability. This is exactly the essence of what Schumpeter called “creative destruction” (Schumpeter, 1934; 1947). As Garud and his fellow researchers (Garud et al. 2013) pointed out: Innovation is not an outcome. It is a process that encompasses the invention, development and

implementation of ideas. Organizations' capability in fostering such innovative process is key for their competitive advantages. Such "creative efficiency" is a crucial dimension in considering governance design in a digital age, because the value of data can and can only be released out of creative work. Following the development of new economy based on data and ICTs, more and more attention from academia and practitioners alike evolved over the last twenty years to tackle the issue of innovation. How to re-design organization to stimulate "creative efficiency" became an increasing concern.

Consistent with North's (2010) notion of adaptive efficiency, coordinative and creative efficiency shows recognition to evolutionary process and diversity of contexts. Organizations are no longer treated as the last resorts to handle market failures, but entities that can combine resources to create new values and resources. Stretching the understandings about efficiency from static to a more evolutionary basis significantly expands the theoretical possibilities to explain the diversity of organizational forms and governance structure. Galunic and Eisenhardt (2001), for example, pointed out that, traditionally, the advantage of an M-form corporation is about decomposition and specialization. That is to say, the relatively independent business units can share decision-making loads with headquarters, especially on operational issues. However, if we apply a more evolutionary point of view, the advantage of those independent business units lies in their ability to increase an organization's chances of responding to environmental changes more rapidly, so that it can better adapt and survive in the competitive landscape it is situated in. Correspondingly, the main use of headquarters is not so much about plan making, but to facilitate the coevolution of dynamic communities in changing markets (Moran and Ghoshal, 1999).

All the observations listed above indicate that it is more and more difficult to locate

governance choice on a two-way spectrum of market and hierarchy, as proposed by transaction cost economics (Coase 1937, 1960; Williamson 1979, 1991, 1996, 2002). Governance is not solely about control and the appropriation of values. The design of organizational governance needs to allow and incentivize coordinated and creative search and execution of combinations of resources that create value collectively. It needs to focus more on the process rather than the state. A new framework to understand, explain and guide governance design is needed.

Multi-dimensional Space for Governance Design

When understanding of governance exceeds the notion of control, when the goal of organizing is no longer confined to value appropriation, and when the standard of efficiency is no longer static, the governance designs of organizations span out of the line between market and hierarchy and enter a much richer three-dimensional space. This is especially true when economy evolves from mechanic to digital. Governance designs that can survive competitions and rapidly changing environment are those, which take all three dimensions into consideration: static efficiency, coordinative efficiency and creative efficiency. Static efficiency is crucial for the facilitation of resource exchanges and is a prerequisite for firms' survival in a competitive environment. Coordinative efficiency enables organizations to combine and motivate behaviors that create values otherwise impossible to achieve. Creative efficiency measures an organization's vigor in searching and testing new possibilities of resource deployment. Although no one can anticipate the results of such explorations, organizations without such ability will eventually decline, given time. Clearly, for an organization to remain viable in the long run, it needs to have certain kind of pluralism and tackle all three dimensions of efficiency.

The problem is that trade-offs widely exist among those three dimensions of efficiency. Static efficiency is best realized in a completely competitive market with atomic economic agents. Its very definition denies the independent role of organization in resource deployment. Coordinative efficiency, however, refers exactly to the value creation potential of organizations in forming an institutional logic that defies market logic, thus enables individuals to work collectively together in ways that are impossible in bilateral exchanges. There is an innate organizational tension between creativity and coordination as well. Being creative means having new ideas, raising innovative solutions, and exhibiting original behaviors (Runco, 2004). Such originality is by definition difficult to predict and control, thus would challenge organizational coordination (Okhuysen and Bechky, 2009). In the meanwhile, certain coordination mechanisms, such as rules and routines, tend to lead organizational members and the organization into more and more predictable and homogeneous behaviors, yet creativity, especially collective creativity comes from the constant recombination of different ideas, knowledge, and perspectives (George, 2007).

Creative efficiency contradicts with static efficiency too. To create, an organization has to have slack resources and allow experiments that fail. These resources and failed experiments can only be considered as wastes if static efficiency is the only measurement. This is the classic tradeoff between exploration and exploitation (March, 1991; Fang et al., 2010). Organizations are oftentimes built on tensions and contradictions.

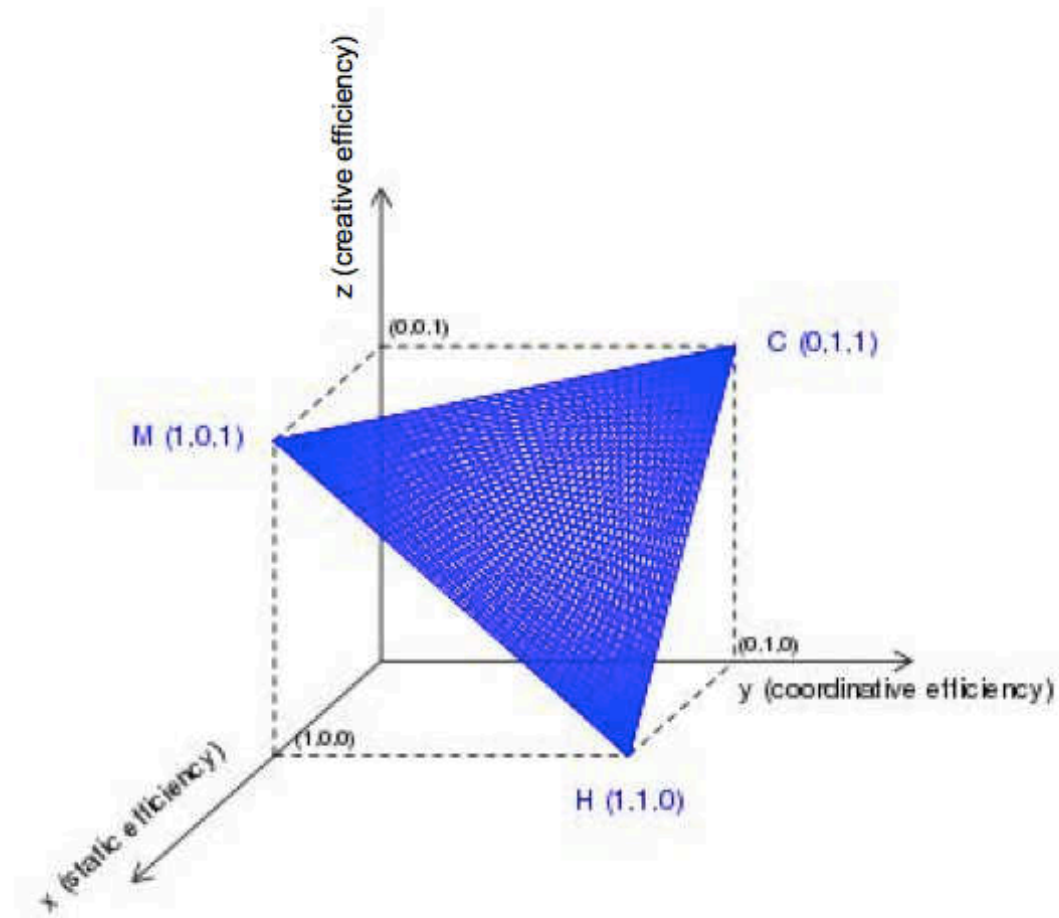
As much as researchers tended to focus on static efficiency and overlooked coordinative and creative efficiencies, even less is known about how to reconcile the divergent requirements of those three dimensions of efficiency with organizational structure and governance modes. Systemic exploration about how to balance those different requirements is a huge research

project that deserves attention and devotion from economic and organizational scholars. In the following part, this paper is going to construct a theoretical model to express a three-dimensional space for governance design, with static efficiency, coordinative efficiency and creative efficiency as three axes. I hope this normative model can serve as a framework to express the relationship among static, coordinative and creative efficiencies, and how the balancing among them leads to a tremendous diversity the organizations and governances modes that way more nuanced, complicated and pluralistic than suggested by transaction cost economics.

A Three-dimensional Space for Governance Design

In order to adapt to the rising challenges generated by data-driven economy, organizations have to evaluate and balance efficiencies along three dimensions in governance design: static efficiency, coordinative efficiency and creative efficiency. We can model this new situation by assigning one axis for each dimension and visualize the range of possible in a three-dimensional space.

Figure 2: A Three-dimensional Space for Governance Designs



Let x axis simulate the static efficiency, y coordinate efficiency and z creative efficiency. We can assume that the range of possible values for x, y and z – and thus the extent of differentiation between organizations on those criteria – is set between 0 and 1.

Moreover we can set three points, namely M, H and C with the following coordinates:

- $M = (1, 0, 1)$. M maximizes static and creative efficiencies
- $H = (1, 1, 0)$. H maximizes static and coordinative efficiencies
- $C = (0, 1, 1)$. C maximizes coordinative and creative efficiencies

Segment MH ($0 \leq y, z \leq 1$) represents all the possible governance designs that optimize static efficiency. Trade-off exists between the resources allocated to increase coordinative (y) and creative efficiency (z). In organizational terms, we face the classical trade-off illustrated in transaction cost economics between hierarchy (H) and market (M). When transactions have high asset specificity, high uncertainty and high frequency, governance design weights to the side of hierarchy so as to decrease transaction costs associated with hold-up risks and opportunistic behaviors. Coordinative efficiency is favored in this circumstance. If transactions are of low asset specificity, low uncertainty and low frequency, then market is favored so that creative efficiency will be enhanced when market players seek self-interest maximization in creative ways.

Segment HC ($0 \leq x, z \leq 1$) represents all the possible governance designs that optimize coordinative efficiency. Such designs are for tasks that require strong coordination with visible hands. Trade-off exists between the resources allocated to increase static efficiency (x) and

creative efficiency (z). In organizational terms, we deal with choices related to the degree of labor divisions and network size of labor divisions. When requirements for local expertise are relatively low, and the network size of labor division is relatively small, static efficiency is favored. However, when requirements for local expertise are high, and the network size of labor division is extremely large, governance design will move towards the point C. A typical example for governance choice towards point C on segment HC is the case of smart cities. As we have mentioned earlier, smart city projects attempt to provide systemic urban solutions at the scale of a district or city. Even if the whole project requires high degree of coordination among interdependent actions, it is impossible to integrate all tasks under one single hierarchical structure, because no organization can master all the specialized expertise needed in such projects and no organization has the massive amount of resources needed to carry out such projects alone either. Governance design for such tasks thus needs to promote coordinative efficiency without losing creative efficiency. That is to say, it has to encourage cooperative behaviors not only through fiat, but also through alternative incentives.

Segment MC ($0 \leq x, y \leq 1$) represents all the possible governance designs that optimize creative efficiency. Trade-off exists between the resources allocated to increase static efficiency (x) and coordinative efficiency (y). In organizational terms, the trade-off comes from the availability of different types of incentives and the interdependency of tasks. When economic incentive alone is enough for driving agents' actions and interdependency of tasks is low, governance choice will weight towards the point M (market) and when both economic and non-economic drives of actors' actions are important and the interdependency of task is high, governance choice will evolve towards the point C. A good example is the case of Valve, which is a world leader in videogames. Valve offers extreme autonomy to its employees and operates

with small auto-formed teams. Such autonomy allows exploration of new ideas and flexibility of the company, or, in other words, enhances creative efficiency. However, coordination among those innovative efforts is also a must so as to make the company as a whole viable. Thus, Valve not only applies economic incentives, e.g. basing compensation on stack ranking, but also pays strong attention to alternative incentives by hiring the right people (innate incentive) and aligns behaviors around clearly communicated long-term goals (group incentive).

All the points situated on the triangular surface of MHC that is defined by the following equation and constraints: $x+y+z=2$ and $x \in [0;1]$, $y \in [0;1]$, $z \in [0;1]$ with three vertices:

□ $M = (1, 0, 1)$

□ $H = (1, 1, 0)$

□ $C = (0, 1, 1)$

are viable governance designs. Organizational leaders can use this three-dimensional model to guide the process of governance design, by first clearly define what is the composition of efficiencies they are aiming at, and then fine tuning their desired governance design according to the nature of tasks, market position and relational and social factors.

Two of the three vertices of the triangle are pure market (M) and hierarchy (H). The vertex C, however, is not a hybrid between market and hierarchy, but a governance design of different nature (Powell, 1990). The difference lies in the recognition of socially situated and constituted agency of organizational members (Westphal and Zajac, 2013). In order to achieve high levels of coordinative and creative efficiencies, governance design has to acknowledge the personal, relational and social factors that shape the cooperative process and organizational

creativity. With the development of digital economy, new governance designs are emerging on the triangular surface this paper identifies and the evolution would be towards the point C.

What is point C? There are not any pre-defined answers. This paper speculates that governance designs towards point C would be close to participative communities. In the following text, this new norm of governance will be briefly discussed.

Participative Community as a New Norm of Governance

Governance used to be treated as an overly simplistic concept of control. Such oversimplification results from under-evaluation of the richness of human incentives, the importance of value creation and importance of social influences on behaviors. Such research tradition tends to rely mostly on formal incentives and monitoring mechanisms that lead self-interested individuals to achieve certain collective outcomes (Westphal and Zajac, 2013). However, formal incentives and monitoring mechanisms can hardly lead to point C, which represents high level of coordinative and creative efficiencies simultaneously.

Yet the behaviors of human actors are never so one-dimensional. Instead, they are formed by social interactions and form social interactions at the same time. Governance designs are not just about controlling opportunistic agency, but also about realizing relational and social capitals embodied in organizational agents for a dynamic process of cooperation and value creation. In order to understand what is point C, we need to examine not only the formal incentives and the formal structures and mechanisms of governance, but also need to integrate relational and social considerations into governance design. Thus, an important, yet relatively less studied

organizational form, participative community, might be a best representation of what future governance designs would be, especially in a data-driven economy.

The traditional understanding of a community is a geographical one (Weber, ([1922] 1978). However, the essence of a community is not about a shared geographical area, it is about shared value systems that can be connected by common territory, family connections, or social and economic needs. Brint (2001) defines communities as “aggregates of people who share common activities and/or beliefs and who are bound together principally by relations of affect, loyalty, common values and/or personal concern.” Although community may or may not be built around economic purposes, the shared value systems provide a solid basis for the alignment of communal members’ incentives and actions. When managed properly, such common values and associated strategic orientations and incentives serve to promote both cooperative and innovative actions, thus form a new norm of governance disparate from market or hierarchy.

In recent years, more and more organizational researchers began to pay attention to such a new way of organization and governance. O’Mahony and Lakhani (2011), for example, argue that community as a form of organizing is becoming more and more relevant in a knowledge-based economy. However, they also pointed out that the importance of communities is not fully appreciated in organizational theory. Schneiberg (2002) has long observed community-like organizations in American insurance in the early twentieth century. He argues that such cooperative organizations represent alternative forms of governance to markets and hierarchies. More recent examples of community-like organizations are abundant with high-tech firms. This paper has already mentioned the case of Valve, which is a videogame company organized around autonomous, self-organized teams. Another good example is the flourishing communities built around open-source innovations. Promoted by ego satisfaction and relational and social incentive

(e.g. enhanced reputation), spontaneous orders are brought about, which enable both innovation and coordination (Raymond, 1999; von Krogh and von Hippel, 2006).

However, our knowledge about communities as a norm of governance is still very limited. Previous research tends to treat community as an institutional logic (Thornton et al., 2012) instead of examining it as one form of economic organization. Future research on communities as a governance form is greatly needed.

Discussions and Conclusions

Data, big and small, structured and unstructured, are greatly altering business world as we know it. Turning data into useful information and even products and services require the cooperative work among creative agents. Productive activities in a digital age are dramatically different from that of the mechanical one. All these changes dramatize the limitations of transaction costs economics. This paper provides a theoretical framework to guide governance design in data-driven economy. It argues that three dimensions of purposes, static efficiency, coordinative efficiency and creative efficiency, should be considered simultaneously at governance design. Business leaders need to make strategic decisions about what composition of these three dimensions they aim to achieve, and then fine-tune governance design according to features of transaction, degrees of specialization, scales and complexity of tasks, competitive landscape and positions, relational and social capitals available, etc. The paper especially raises attention for participative community as a new norm of governance in digital age. Further research are greatly needed to test the theoretical model proposed here and explore participate community as a new norm of governance in more detail.

CHAPTER 3:

Herding Cats: Deciphering integrative coordination process in digital age

ABSTRACT

The realization of any social purpose is a collective endeavor. Information technologies have enabled human race to tackle more and more ambitious systemic goals, in the meanwhile, the complexity and uncertainty of interdependencies among tasks are also rising sharply. The aim of this paper is to answer the question: *what facilitate an ongoing integrative coordination process when interdependencies are complex and uncertain*. By conducting a multiple-case study on six collaborative organizations on smart city projects, three of which in China and three in Europe, this paper attempts to identify organizational elements that interact with the coordinative mechanisms to enable the dynamic process of integration. The research results are a set of propositions that extend and challenge existent understanding about how to better facilitate integrative coordination process in information era. This paper advances literature on organizational structure, social network and complexity theory, and contributes to theories of integrative coordination, especially inter-organizational coordination.

Keywords:

Integrative coordination, complexity theory, process theory, semi-structures, layered-distributed system

Introduction

In the past two decades, research interest in coordination – the process of integrating interdependent actions to achieve a collective set of tasks (Van de Ven, Delbecq & Koenig, 1976; Heath & Staudenmayer, 2000; Quinn & Dutton, 2005; Faraj & Xiao, 2006; Okhuysen and Bechky, 2009) – has been reviving. The renewed attention to this essential construct of organizational theory corresponds with the impacts information technology has brought to work and organizing.

The wide applications of information technology required and enabled work of ever-higher degrees of complexity and uncertainty in task interdependency. As the logic of production shifted from engineering to information, work becomes increasingly knowledge-based and creative in nature. Single best solutions did not exist anymore, and processes towards completion became difficult to estimate (Kraut & Streeter, 1995). The interdisciplinary tasks require the collaboration among various specialists, and the nature of work is increasingly ambiguous, unpredictable and hard to measure. Furthermore, recent developments in technologies make it possible to integrate tasks, organizations, and industries that were not usually integrated before, in order to obtain larger social purposes. Transactions and collaborations across boundaries, either the boundaries among business units, organizations, industries, or countries, have become common, thanks to better-standardized interfaces and more means of telecommunication (Siggelkow and Rivkin, 2005). The blurring boundaries raised challenges to the applicability and effectiveness of certain widespread integrative coordination mechanisms, foremost formal

hierarchy. In her empirical work, for example, Metiu (2006) showed that installing formal mechanisms indicating status difference across units can harm the sense of autonomy of participating groups, thus cause coordination breakdowns.

The trends identified above challenged the earlier “design” approach on integrative coordination, which assumed that work and organization can be deliberately designed with rationality to achieve an optimal outcome (Fayol, 1949; Chandler, 1962). As a result, recent research on coordination has shifted to an emergent approach, which recognized coordination as an ongoing process that unfolds along time and with context (Gittell, 2002; Quinn and Dutton, 2005; Faraj and Xiao, 2006; Valentine and Edmondson, 2015). When basic assumptions about coordination shifted from a prescriptive approach to an emergent approach, scholars need to address not only the question of “what mechanisms executives should apply to accomplish coordination”, but also “how does the adaptive process of coordinating happen”. However, most existent research still relies on describing how one or several coordinative mechanisms work, yet lacks a theoretical framework to explain the dynamics that erode or support the *process* of coordinating. The review paper of Okhuysen and Bechky (2009) partially addressed this theoretical gap by synthesizing three integrating conditions for coordination: accountability, predictability and common understanding. Yet the authors also acknowledged that those integrating conditions are necessary but not sufficient for coordination to occur and last. Normal dynamics in everyday practices, such as turnover and mistakes, will constantly erode these conditions and cause coordination breakdowns. Thus, in order to fully address the question of “*what facilitate an ongoing integrative process in the information era*”, we need to go beyond examinations on coordinative mechanisms themselves, and try to understand how other

organizational elements interact with the coordinative conditions to enable the dynamic process of integrating.

Due to the limited theoretical and empirical literature, this paper takes a theory-building approach (Eisenhardt, 1989b; Eisenhardt and Graebner, 2007). The empirical setting is six collaborative organizations on smart city projects. By conducting within-case and cross-case analyses, we identified structural, relational and procedural organizational elements that led to lasting and performing integrative coordination in the information era. This paper advances literature on organizational structure, social network and complexity theory, and contributes to theories of integrative coordination, especially inter-organizational coordination. The research results are a set of propositions that extend and challenge existent understanding about how to better facilitates integrative coordination process in information era.

Theoretical Background

Several theoretical perspectives can shed light on the integrative coordination process in information era. First, there is the vast literature on organizational structure. It is widely acknowledged that structure has a strong influence on process and *vice versa* (Chandler, 1962; Miles et al., 1978; Fredrickson, 1986). Two structural dimensions are especially pertinent to integrative coordination with uncertain and complex interdependencies: hierarchy and modularization.

The word “hierarchy” in organizational research is usually associated with a sense of subordination (Simon, 1962). In a hierarchical structure, decision-making and performance measurement is concentrated to a few (Fry and Slocum, 1984; Fredrickson, 1986). When the

collective goal of an organization is to provide complex goods and services, the productive process requires continuous knowledge development and transfer (Nickerson & Zenger, 2004). Such complex collective and often cross-boundary efforts impose high coordination costs. Earlier researchers of organization structure argued that central authority is the best solution to minimize such costs, as it reduces some of the problems associated with bounded rationality (Simon, 1972), and opportunism (Williamson 1985), and is thought to economize the transmission and processing of information. Simon (1962), for example, argued that hierarchy is one of the central structural schemes that the architect of complexity uses. However, by hierarchy, he meant “a system that is composed of interrelated subsystems, each of the latter being, in turn, hierarchic in structure until we reach some lowest level of elementary subsystem” (Simon, 1962: 468).

Apart from being considered an effective structure in face of complexity, hierarchy is also thought to be a good structure to deal with uncertain interdependencies (Staw, Sandelands, and Dutton, 1981). Too many decision makers and lateral structure could slow the decision process (March and Olsen, 1976). In uncertain situations, organizations without central authority can have difficulties in making timely strategic choices, thus cause integrative coordination to breakdown (Sanchez and Mahoney, 1996).

However, centralized structure puts strong cognitive demands on top managers. When the scale and complexity of task exceeds the executive’s information processing power, the benefits of centralization for integrative coordination decreases. Recognizing the bounded rationality, researchers have long turned to “loosely coupled” (Weick, 1976; Orton and Weick, 1990) organizational components to reduce the information processing demand on top management. By organizing work into modular units, operational information related to the module can be

processed within the unit, hence reduce the amount of information processing necessary for individual executives (Chandler, 1962). Modular structure allows an organization to decompose tasks into nearly independent sub-tasks, thus lessens the burden for overall integrative coordination.

In order to better deal with complexity and uncertainty, the effects of hierarchy and modularization over integrative coordination process can be combined when modular structure is embedded into a hierarchy. The most prominent example of such structure is an M-form corporation. In such organizational structure, operational decisions are primarily made in modular units and strategic issues are dealt with on the corporate level (Chandler, 1962; Freeland, 1996).

Albeit diverse, overall, organizational structure literature took a top-down and deliberate approach to coordination. Much of the literature indicates the necessity and effectiveness of formal structure and information processing power of executives in guiding the integrative coordination process.

Disparate from organizational structure literature, social network theory emphasizes how structure is emergent from the interactions among actors, or, to be more specific, from the relationships among dependent actors (Granovetter, 1985; Freeman, 1992; Wasserman and Faust, 1995). Organization, from social network perspective, is more a network of relations, rather than a clear hierarchy. Accordingly, coordination is not just a formal process shaped by structural arrangements, but more an interactive process shaped by social relations. A key difference between structural view and relational view upon integrative coordination is that structural view stresses the cognitive power of individuals in integrating pieces of information to create

knowledge, but social network theory argues for the knowledge creation power of connectedness. Social relations provide channels to transfer information, knowledge, ideas and other resources, hence facilitate the integrative process at all levels of organization, and even across boundaries of organizations (Coleman, 1990), to achieve desired outcomes (Gittell and Weiss, 2004). Compared to the structural view, network theorists emphasize more the informal mode of coordination. In general, they argue that rich personal relational ties among actors have a positive impact on integrative coordination, because those ties enable actors to embrace their interdependence, hence allow them to better coordinate (Okhuysen, 2001; Gittell, 2002). Gittell (2002)'s empirical research in the context of patient care, for example, found that the positive impact of three formal coordination mechanisms – boundary spanners, team meetings and routines – on performance is mediated by relational elements, such as intensive communications and relationships. Quinn and Dutton (2005) proposed a theory of coordination as energy-in-conversation to describe how people's energy in their attempts to coordinate affects the coordinated performance. A variety of relational capital, such as familiarity (Okhuysen, 2001; Gittell, 2002), trust (Tsai, 2000, 2002) and shared vision (Li, 2005), are reported to foster integrative process among interdependent tasks.

Although social network theory has strong explanation power for integrative coordination process in the information era, especially as regard to knowledge creation, some of the findings of this line contradict with the findings of the structural view. Take Tsai (2002) for example. His empirical research on the 24 units of a PVC company discovered that formal hierarchical structure, in the form of centralization, has a significantly negative effect on cross-unit coordination (in the form of knowledge sharing), while informal lateral relations, in the form of social interaction, have a significant positive effect. Moreover, the quality and performance of

coordination in this stream of research is often measured by simple activities, such as knowledge transfer and information sharing (Tsai, 2002; Li, 2005; Li, et al., 2006). Empirical evidence on how relational capital support integrative coordination involving significant collective activities is scarce.

Another stream of research turned to complexity theory to decipher the integrative coordination process in information era. Unlike network theory, which stresses the interdependence among actors, complexity theory emphasizes the independence of actors, or, in their term “agents with schemata”, which refers to agents with a cognitive structure that determines what action the agent takes (Anderson, 1999). These agents are partially connected. They interact with each other in nonlinear fashion. On the first sight, this way of modeling inevitably leads an organization to overwhelming complexity and ambiguity, hence make any coordinated efforts hard to achieve. However, complexity researchers observed that coordination could occur from the interaction of agents with relatively simple rules. In other words, interactive agents could “self-organize” towards order, albeit this order is usually on the “Edge of Chaos” ((Drazin and Sandelands, 1992; Anderson, 1999; Davis et al. 2009).

Following complexity theory, two elements can have deterministic influences over the coordination process. First, there is the cognitive structure, or the schemata, of the agents. As coordination is considered an emergent process generated by the interactive behaviors of all agents, the cognitive structure agents apply to interpret information, to make decisions, and to connect with others have fundamental impact upon the aggregate outcome of the whole system (Anderson, 1999). What the cognitive structures are, how diverse such cognitive structures are among agents, and how they evolve over time, all these shape and are shaped by the interactions among agents, hence strongly correlated with the performance of the integrative coordination

process (Paul et al., 1996). Second, there is the design of feedback loops, i.e., the tempo and methods with which outcome of time t is reviewed. The output of the interactions among agents at time t is the input that affects how agents treat each other at time $t+1$. Suppose coordination is needed because there is a collective goal shared by all agents. When the interactions among agents lead the whole closer to that collective goal, certain behaviors will be reinforced and certain be discarded. Features of such recursive loops steer complex and multi-agent interactions towards self-regulation. Integrative coordination occurs along with this co-evolutionary process among agents (Drazin and Sandelands, 1992).

Although complexity theory has attracted much academic attention in recent years, not many organizational researchers have used this theory to examine how organizational elements affect the integrative coordination process, despite the great potential. The paper of Martin and Eisenhardt (2010) applied complexity theory to examine cross-unit collaborations in multibusiness organizations. They collected and analyzed data from twelve collaborations in six publicly held software firms and confirmed that general managers of business units, instead of corporate executives, are central drivers for high-performing cross-business unit coordination. The business units' general managers exhibited strong capabilities to recombine resources among units, and drive the coevolution of the "complex adaptive system" of modular, unique and partially connected business units (Martin and Eisenhardt, 2010). Such empirical finding is consistent with complexity theory. Yet more research is called upon to further understandings about integrative coordination process from complexity theory perspective.

To sum up, organizational structure theory, social network theory and complexity theory all shed some light on understanding the integrative coordination process in information era. However, the implications stemming from these three perspectives are hardly congruent with

each other and sometimes, the findings along different lines of perspectives are even contradictory (Rowley et al., 2000; Li, 2005). Empirical research that goes beyond the examination of coordination mechanisms is scarce. There is still great lack for a process theory that directly addresses the dynamics between various organizational elements and the integrative coordination process, especially in the information era where interdependency is complex and uncertain, and organizations are increasingly “boundaryless” (Arthur, 1994).

Method and Empirical Setting

Due to the limited theoretical and empirical literature, this paper takes a theory-building approach (Eisenhardt, 1989b; Eisenhardt and Graebner, 2007). We made a multiple-case study upon six collaborative organizations on smart city projects, three of which in China and three in Europe. The number of cases and the variation in their geographical location enhance the validity and generalizability of our findings.

We took smart city projects as our empirical setting because they represented a typical integrative coordination challenge in the information era. A city, or a district of a city, is considered “smart” when solutions for disparate aspects of urban life, such as energy, water, waste treatment, transportation, are tackled as an interactive system enabled by big data analytics and ICTs (Information and Communication Technologies). By integrating data and information from various aspects into a shared platform, cities can be more efficient, convenient, agreeable, environmental friendly and inclusive. In short, they can be “smarter”. The construction of a smart city is a large-scale systemic project. The process of constructing them is typically representative of integrative coordination in systemic projects enabled by information and

communication technologies. The ambitiously large scales of smart city projects means they have to be carried out by multiple players from a diverse range of industries, which may or may not traditionally work together. As the work carried out are often close to the technical cores of respective groups, the boundaries among participating parties are blurry. The successful enforcement of smart city projects commands strong collective actions of all parties in order to fulfill highly interdependent tasks. Moreover, as the projects often involve creative work, it is difficult to define all tasks ex-ante and progress towards completion is difficult to estimate (Kraut & Streeter, 1995). All these features mentioned above made integrative coordination in such projects especially pertinent yet difficult to achieve and maintain. Thus, smart city projects provide a perfect empirical setting to study the research question under examination. In all the six cases we picked, certain organizational structures were formed to carry out the projects. It is our purpose to identify key organizational elements that affect the quality of integrative coordination in those projects, and the dynamics between those elements and the coordination process.

The six cases were chosen with the assistance of two authoritative organizations specialized in promoting smart city projects. The three Chinese cases were suggested by Digital City Engineering Research Center of the Ministry of Housing and Urban-Rural Development of China. We asked two leaders of the Research Center to name the smart city projects that they believe had performed best and worst in integrative coordination. Each of them suggested three best cases and three worse cases. We then asked them to describe the maturity, scale, complexity, and number of participating organizations of each project. After comparing their answers, we made preliminary choices of six comparable cases, three well-performing and three poorly-performing in integrative coordination. We then made preliminary telephone interviews with key

figures, usually the chief project manager, from every project. We also questioned them about the maturity, scale, complexity and number of participating organizations of their respective project. Then, we demanded them to self-rate the desired and achieved level of the integrative coordination of their projects. We finally chose three cases, one with relatively good performance in coordination, one average and one poor, which are the most comparable in maturity, scale, complexity and number of participating organizations. Only cases with a high fit between external evaluation by the Research Center and self-rated evaluation were chosen. The European cases were identified with the help of the Global Advisory Committee of the Smart City Expo. Similar procedures were taken to identify the European cases.

All the six cases were on ongoing smart city projects with lasting organizational structures. We only chose projects with integrated goals, i.e., projects that aimed to tackle various aspects of urban lives with a shared platform, as this kind of projects could best reflect coordinative needs with complex and uncertain interdependencies. All projects were on one specific district of a city, except for the case of River Village, which was a citywide project. The projects were typically 3 to 7 years of age, and were in the full swing of operation. The exception was Business-U. This project was in its 11th year and was already approaching finishing. All of these six cases involved inter-organizational collaborations (5 to 10 major partnering organizations). In all six cases, certain organizational structures were established to manage the projects. Roughly, we divided the organizational members into two categories. One was project coordinator. In this paper, these coordinators were referred to as “project managers”, or “PMs”. It was their responsibility to manage the advancement and performance of the overall projects, and coordinate the integrated efforts of all participants. In two of the cases, project managers came from private companies (e.g., Smartie, Business-U); in two cases, they were from public

bodies (e.g., V-City, River Village) and in the other two cases, they came from a mix of private and public entities (e.g., Flower River, Lakeside). The other category was project participants. In our cases, these were typically the representatives of industrial partners of the project. In this paper, they were referred to as “representatives”. It is worth noticing that in some of the cases, one organizational member served multiple roles in a project, in those cases, we labeled them according to their most salient role. According to this categorization, we identified three types of informants for this study: the project managers, the representatives, and external experts.

Table 1: An Overview of the Cases

Name*	Location	Starting Year	Project Focus	Number of Major Partners	Informants Interviewed	Informants Interviewed by Type
V-City	China	2010	smart governance and services	8	10	Project manager: 3 Representatives: 6 External Expert: 1
Flower River	China	2009	smart services	7	8	Project manager: 3 Representatives: 5 External Expert: 0
Lakeside	China	2013	smart energy and services	9	10	Project manager: 3 Representatives: 4 External Expert: 3
Smartie	Europe	2012	smart energy and services	10	11	Project manager: 5 Representatives: 5 External Expert: 1
River Village	Europe	2008	smart governance	6	9	Project manager: 2 Representatives: 6 External Expert: 1
Business-U	Europe	2005	smart services	3	7	Project manager: 3 Representatives: 3 External Expert: 1

* All the names were pseudonyms for the reason of confidentiality.

** Several informants were interviewed more than once.

During the process of data collection and data analysis, we used three dimensions to measure the degree of integrative coordination, in order to confirm the cases were rightly labeled. The first dimension is the rating by the project managers about integrative coordinative performance of their respective projects on a ten-point scale. The second dimension is the rating by the representatives about the degrees of integrative coordination of the projects they participated. The third dimension is the rating of external experts. They were highly knowledgeable about the focal case and usually possessed good understanding of the relative performance of the focal project to other similar projects. Good integrative coordination is identified when the rated coordinative performance were consistently high (≥ 7) for all kinds of ratings (average of each kind). Poor integrative coordinative performance was identified when the rating of coordinative performance was low (≤ 4). For the case of Flower River, it was labeled medium as both the ratings from the project managers and representatives were 5, indicating moderately successful performance. For the case of River Village, there were some inconsistencies in the ratings from various sources. The ratings from the project managers were significantly higher. Considering the cognitive tendency for project managers to inflate their ratings about their own projects, this project was still labeled as “medium”, according to the ratings of the representatives and external experts.

Table 2: Coordinative Performance

Name	Coordinative Performance	PM Rating*	Representative Rating*	External Expert Rating*	Coordinative Outcomes	Quotes
V-City	High	8	9	10	Successful installation of shared data center; Smart traffic control system in operation; Other smart governance systems in progress.	"The projects were well managed." (Representative) "We have established a new collaborative model." (PM) "V-city was a highly successful case." (Expert)
Flower River	Medium	5	5	N/A	Ambitious plans were initiated; Smart IC card system in progress yet slowly; Low rate of usage for established systems.	"(The projects) became more and more...(laugh)... scary." (PM) "The process of coordinating with others were tedious." (Representative).
Lakeside	Low	3	5	3	Studies of the field had been accomplished; Masterplan still in debate; Few smart systems in operation.	"Well, we were not as mature as XX, but compared to YY, we were OK." (PM) "I did not know what we were doing, truly..." (Representative) "How to say... It was not moving. They were too slow." (Expert)
Smartie	High	9	9	9	Highly innovative smart grid installed; Smart public lighting and traffic management; Increased residents' satisfaction;	"Our consortium was new. We are pioneering this industry." (PM) "We do not just finish the project. We find the business model."(PM) "I would say this is a good project compared with my other experiences." (Representative)
River Village	Medium	8	4	5	Installation of several smart governance systems; Increased application of green tech.	"We are the best." (PM) "I do not need to communicate with them (other partners), unless...un... there was that time..." (Representative)
Business-U	Low	5	3	3	All realstate constructions finished; Few smart systems in place.	"I mean, we tried our best and the project was a success." (PM) "Yes, we worked with the contract." (Representative)

*All the ratings were on a scale of 0-10. 0 stands for "unsuccessful", 5 stands for "moderately successful" and 10 "highly successful". The ratings presented in the Table is an average of inputs.

Data collection

We utilized both first-hand and second-hand data for our research. First-hand data was collected from several sources. The most used source is face-to-face interviews. Some follow-up data were collected by telephone calls and emails. We also sent out questionnaires to our interviewees to collect numerical data, such as their rating of the quality of their projects' integrative coordination. We also relied on second-hand data such as press releases, internal documents and online materials. The diverse sources made sure that we collected as much information about the cases as possible and triangulation helped to boost data accuracy and the robustness of our propositions. Overall, we made 59 semi-structured interviews in a period of eleven months. We interviewed two types of informants. One is the project manager of the whole smart city project, and the other is the representative of participating organizations in the project. Usually, we contacted the project managers first and then asked them to introduce us to the representatives from participating organizations.

We asked the informants three categories of questions. First, we asked them to provide background information about their project, especially the objectives, maturity, scale, resources, and participating organizations. Second, we asked the informants to describe their role in the project and their relationships with other key players in the projects. Third, we asked them to describe the chronology of the coordination process among various participating partners from day one. Both open- and closed-ended questions were raised. However, we did not ask any questions that would lead our informants to predefined judgment. Follow-up questions were raised when the informants' answers were brief or especially informative, yet those questions stayed strictly neutral.

In order to collect unbiased data, we made sure that for each case, we interviewed key stakeholders with different roles: project managers, representatives from participating organizations, and external experts. We interviewed only informants who were highly knowledgeable about the case. We used “courtroom questioning”. All the questions are factual. We informed all our informants before the interview started that all the information collected would and would only be used for academic research and their names, the names of their company, and the names of the smart city projects under investigation would be kept anonymous.

Data Analysis

We took a ground theory-building approach, thus no hypotheses was raised before data analysis. Following the procedures advised by Eisenhardt (1989b), we conducted within-case analyses first. We constructed numerous write-ups by synthesizing the information collected from different sources. Initial analysis was made to form concepts and constructs pertinent to integrative coordination. In this phase, we wrote as many write-ups as possible to maximize the scope of our search for possible theoretical explanations. All write-ups are emergent from the data we collected about the cases.

We then made initial general cross-case analysis to identify the initial propositions of this paper. After within-case analyses, we first compared the two cases with high coordinative performance, in order to identify similar features and practices. Then, comparison was made between the two cases with medium performance and low performance. Later on, we analyzed the Chinese cases together. We first compared the case of good and poor performance, and then compared each with the one of medium performance. Similar analysis was conducted for the

European cases as well. Lastly, we used random pairing technique to examine the validity of our findings.

After this round of data analysis, we went through previous literature to search appropriate theories that could explain the data we collected and initial propositions we found. Some propositions were modified with the theoretical insights provided by previous research and new propositions emerged at this stage as certain theories led us to examine the data we collected with alternative approaches. Those propositions turned out to have a good fit with our data. Existing literature also allowed us to make sense of our emergent findings and helped us to re-organize our propositions into a consistent theoretical framework.

Following the replication logic of multiple-case study method (Yin, 1994), we tested our propositions repeatedly with each and every case. Only theoretical relationships with a strong fit with all cases were kept and the weak ones, or the ones inconsistent with some cases were discarded. The resulting propositions and theoretical framework are strongly supported by our data and some of the previous theories as well. We present our findings in the following part of this paper.

Deciphering Integrative Coordination Process in the Information Era

The aim of this paper is to answer the question: *what facilitate an ongoing integrative coordination process when interdependencies are complex and uncertain*. We attempt to identify organizational elements that interact with the coordinative mechanisms to enable the dynamic process of integration. Our findings pointed to the crossings of structural view, social network theory and complexity theory. They enabled us to discover the complementarity of those theories

and advanced their applications to integrative coordination process and organizational life in general.

Layered distributed system

Structural view and social network theory have different inferences about whether hierarchical structure enables or hampers integrative coordination with complex interdependency. From the structural perspective, hierarchical structure indicates a clear line of decision-making. In the case of complex interdependency, such clarity economizes the transmission and processing of information, and enables faster decision-making compared to lateral structures. In contrast, relational view weighs to a “flatter” structure and emphasizes the role of connectedness in facilitating integrative coordination with complex interdependency, as rich ties provide more channels for information flow and indicate richer social capital, such as trust, which is deemed beneficial for coordination (Tsai, 2002).

Our findings echo previous literature from both structural and relational views yet exhibited significant differences. We discovered that the projects excelled in integrative coordination did not have a “flat” structure, yet it is not a traditional hierarchy either. The successful projects are organized as a layered distributed system that is close to Simon’s (1962) description of a “complex system”, i.e., “(a system) made up of a large number of parts that interact in a nonsimple way” (Simon 1962: 468).

Such system is similar to a hierarchy in the sense that there are different levels of decision-making power, and on each of these levels, there are certain degrees of centrality in decision-making. Strategic decisions that concern all subsystems were usually made on the

system level, and inside each of the subsystem, there were leader(s), who led the decision-making process concerning subsystems under them. This hierarchical structure extends to the most elementary level of organizing.

However, such system is disparate from a hierarchy in the following three aspects. One, the authoritative relationship in such system is not linear. In other words, this layered system does not suggest any relation of subordination, or status differences among actors. The concentration of different kinds of decision-making power represents specialization in roles, rather than disparity of status. The *raison d'être* of having the layers and centralization is about the facilitation of system coherence and coevolution (Galunic and Eisenhardt, 2001), rather than the control of agency problems (Williamson, 1991; 1996). Second, unlike in a traditional hierarchy, where agents, either an individual or a group, serve a specific role with a specific hierarchical position, agents in the organizational system we observed can play different roles on different layers at the same time. Third, the decision-making process is usually collective. Multiple stakeholders, rather than one executive, participated in the decision-making process on the system level, as well as the subsystem level.

The system we observed was also distributed, which means that the system was made up of several autonomous subsystems. This distributed system is similar to a modular structure in M-form corporation. However, there are notable differences as well. Most saliently, the logic of designing M-form corporation is top-down. The purpose of having the modules is foremost the decomposition of tasks in order to elevate cognitive pressure upon top executives (Chandler, 1962). Yet the logic of having a distributed system is emergent. In such a system, subsystems are not simply operational units that carry out what are decided at headquarters, but rather independent processors of local information and knowledge. Nonsimple interactions among

subsystems led information to go in different directions in this system. Such interactions influenced decision-making on both system and subsystem levels. As a result, unlike in a traditional modular structure where division of tasks among subsystems is clear-cut, certain overlapping of functionalities and activities among subsystems is often spotted in a distributed system.

A salient example of this layered distributed system we described above is the case of Smartie. Smartie was a smart city project in Europe. It was initiated in 2011 and contained a business district of 160,000 m² office space and a residential district of 2,000 apartments. The aim of the project was to take advantage of Internet of Things and big data analysis to optimize energy production and distribution, provide better social services and enhance the inclusiveness of community life. It was an ambitious project led by a private real estate developer, Bliss Real Estate, and participated by nine other industrial leaders from different industries. In order to carry out this complex project and coordinate the efforts from all partners, a consortium was formed as an organizational framework to manage the project. Bliss and the nine industrial partners each designated one person to represent their company in the consortium. The representative of Bliss, Gary, served as the project manager of Smartie and a central coordinator of the consortium. The monthly consortium meeting was the highest decision-making institution, and all strategic decisions concerning the overall project were made in those meetings collectively by all partners. During these meetings, Gary had the responsibility of leading the discussions and resolving conflicts. Under the consortium, there were ten working groups, each of which was responsible for certain aspect about Smartie. All working groups enjoyed significant autonomy in making decisions concerning the tasks they were in charge of.

This consortium and its working groups serve as a great example of the layered distributed system we described above. As Gary said:

...we have a governance that has different layers. I manage all the partners but we also have working group on each topic. One partner is in charge of a working group and gathers all other partners, from the pool of all ten partners. They choose the best partners to work together on this topic and have full liberty to decide what they want to do and how they want to do it. So, we have a multi-layer governance. At the highest level, we mainly follow the master plan of the project but on each level, on the residential or commercial buildings and so on, they are working groups. Bliss is part of some working groups, but not the leader. You have different responsibilities. The principle is that every major company is in charge of one or more working groups. I think it is important for everyone to have responsibilities on one part of the project.

At the system level, decision-making was collective and emergent from interactions among subsystems. As one representative pointed out:

We have been working with other (partners) and signed this consortium agreement. Most of the important decisions we want everyone to agree with this decision. From the very beginning, we try to be balanced. We need to share, we need to communicate and that is something big groups are not used to.

The relationship between system and subsystem was not top-down and the interactions among subsystems were complex. Such complexity actually respected the complexity and uncertainty of task independencies in such kind of project. Information and influences went in different directions. Decisions made on the subsystem level were respected by system, and *vice versa*. Like one of the representatives related:

Yeah, then that is the interesting thing with this kind of project. You really have IT and energy people and they need to work together. We decided still, at the beginning of the project we decided together with Gary, to split up into working groups, to have parallel groups to dedicate to residential buildings, commercial buildings, IT, etc. By dividing up, the problem we face is that we may have decisions that are not compatible. On the other side, we can progress more rapidly, because for example, if you want to wait for agreements from all partners about every decision, then you will wait forever. In addition to that, there are some groups, such as the IT group that works across groups. They are able to invite others to join their groups.

As smart city projects were usually extremely integrated, it was impossible to have clear-cut divisions of tasks among those working groups. As Gary described:

(The) working groups are transversal. For example, we have a working group on data. It is global for every and each group because every and each working group is dealing with topic will produce data. So, you have crossing among different groups. We also have the working group of business model that needs the contribution from all groups.

What is more, as each of these working groups was led by one industrial partner, and joined by a few other partners that were related to the task. Every partner participated in the activities of multiple working groups and took multiple roles. Overlapping of members and activities of those working groups was extensive.

In the case of V-City, we observed similar layered distributed structure, although less institutionalized. As Liu, a project manager of V-City described (translated from Chinese):

We do not have general contractor. We chose our partners to form a project board. As there are specialized areas, we also invited external experts, as consultants, to be on our board. We have project teams, many project teams under our board, like planning team, developing team, and what not. Basically we are a system like this. We form this structure for communication and decision-making. Although we chose our partners for their specialized skills and knowledge, we want people to work together. So, we have this platform where everyone can update where they are and we have regular meetings, it has

to be face-to-face, to discuss and decide on important issues. I think it is a good learning opportunity. People like it. It was a chance to learn from each other and synchronize.

Why would this layered distributed structure be advantageous for integrative coordination to occur with complex and uncertain interdependencies? A key insight is that such structure takes advantage of a hierarchical structure in facilitating decision-making and steering collective efforts to a same direction. While at the same time, the distributed subsystems serve as parallel processors of information. Participants of this system can work towards a collective goal yet autonomously detect and respond to local problems encountered. As the demoralizing effects caused by status differences is diminished in this system, participants usually exhibit stronger drive to act and engage into problem-solving spontaneously. The balance between collective coherence and individual autonomy was maintained and reflected in the choice of coordinative mechanisms as well. Smartie, for instance, was very sensitive to any coordinative mechanisms that indicated status differences. Both Gary and a number of representatives expressed their contentment about not having heavy reporting, or other forms of formal control mechanisms. A representative said, for instance, that,

Some of these collaborative projects are somewhat lost, lost due to heavy governance.

That is clearly something we have seen. ... we have the advantage of this light reporting, light process and then we can work more efficiently. ... Smartie does not have subsidiaries, that also means that nobody deserves a strong reporting whatsoever. So we

take that away, and focusing really on what is the value we can bring. That is important also.

In the meanwhile, coordinative mechanisms that enabled information exchanges, especially those that enhanced information visibility, were widely applied, albeit different projects chose to use slightly different tools. Smartie and V-City both established digital information board where participants could upload and download real-time information about all system and subsystems. Flower River relied heavily on social media tools and mobile APPs that enabled group and one-to-one communication. Together with the distributed structure, real-time information sharing and high information visibility increased the overall system's information processing capability (Eisenhardt, 1989). What is more, information visibility as a tool of coordination indicated stronger member inclusiveness and higher respect to subsystems' autonomy (Mark, 2002). Rich information flows in all directions also increased familiarity among participants and thus provided favorable conditions for collaborative intentions to develop and complex interdependency problems to be worked out.

Another advantage of this layered distributed system is that it decreases the cost of coordination by strengthening the overall system's tolerance to mistakes and shocks. In such a layered distributed system, information is transparent and stored not only on the system level, but also on subsystem levels. Each subsystem is an autonomous information processor, which is parallel to other subsystems. With such an arrangement, information storage and information processing may have certain repetitions among subsystems, but for the overall system, even if mistakes occurred in one of the subsystems, or if there were an external shock, the possibilities

for the whole system to endure this mistake, or withstand the external shock could be significantly higher. The overall system could function even with local mistakes. As one project manager of the V-City project noted:

We have a common platform to share (information about the work of different project teams). They (the project teams) work with their expertise. But among them, the coupling is not very tight. I mean, for their skills, they are different. It is that concept, but if the coupling were too tight, the cost of coordination and communication would be too high. If one part went wrong, the whole system would stop working. Some overlapping among project teams is inevitable and we intend to keep it that way.

Such tolerance to local mistakes and resilience to external shocks are especially valuable for integrative coordination when interdependencies among tasks are too complex and uncertain. As Okhuysen and Bechky (2009) pointed out, mistakes in everyday activities of an organization can constantly cause coordination breakdowns, as they erode coordinative conditions of accountability, and predictability. When interdependencies are complex and uncertain, not only the rate of potential mistakes is inevitably higher, many coordinative mechanisms, especially ex-ante coordinative mechanisms are more difficult to apply. Although a distributed system cannot decrease the number of mistakes in the system, it decreases the negative impact of any single mistake on the system. As a result, this structure increases overall reliability and stability of the system. Such system reliability and stability has strong significance for integrative coordination, even if it may sacrifice some efficiency due to possible repetitions among subsystems.

To sum up, layered and distributed structure took advantage of both hierarchy and flat structure. It enhances the performance of the overall system by maintaining the system coherence and enhancing local search. The complex interactions in the system best reflect the complex interdependencies among tasks in information age, thus make it a good structural choice to facilitate integrative coordination under such circumstance.

Proposition 1: Layered and distributed structure is beneficial for facilitating integrative coordination, when interdependencies are complex and uncertain.

Building the Common Grounds on Differences

As the above-described layered distributed system cautioned against fiat-kind of formal authority, we could have imagined that in this case, other control mechanisms, such as predefined rules and plans, or shared norms, should be well developed in advance in order to maintain coherence in those complex projects (Ghoshal and Partlett, 1988; Li, 2005). Such hypotheses are consistent with the predictions of the structural view and social network theory. According to structural view, for example, formal plans are indispensable to organizing, as they define the purpose of organizational activities (March and Simon, 1958). Executives are expected to make those plans and hand them down the hierarchical ladder (Taylor, 1914; Fayol, 1949) so that all organizational members would judge and choose with similar standards. Social network theory also suggests that shared goals and understandings are necessary conditions for coordination to occur because such common grounds motivate organizational members to combine and share knowledge (Nahapiet and Ghoshal, 1998; Li, 2005).

To our great surprise, our data did not fully support those arguments. For the two best-performing cases, master plans were indeed made but they were board-brush, emergent and subject to change at all times. As one of the project managers of V-City, Chen, described (translated from Chinese):

We have some top-level planning, mostly principles, about the project. That is to say, we would anchor some aspects, rough concept of construction, the general technical direction, framework... We comb through these things to prepare a basis for the upcoming concrete development, a rough preparation. We do not make operational plans about what each project team needs to do. Like, for building the 115 Digital Street, we make tentative standards that need to be achieved. In the operational process, we work together to adjust those standards and make tentative plans, just enough to guide our work. Then, we work to achieve these standards. When we encounter a problem, we look for a better solution and update the version of planning. And this process of continuous updating goes on. After some time, people naturally accept some working rules and work accordingly, we only adopt those as plans and rules then. Because there are many things we cannot think of at the beginning, especially now that the technologies change so fast, and the needs of clients change fast as well.

Gary, the project manager of Smartie, also stressed:

What I would say is: do not write down everything. Leave parts of flexibility because when it will be functioning, you will see the limitation of your first master plan. So, leave your flexibility to change. When I say change it can be quite tricky, because a building cannot be changed or moved. But I would say, leave space for roads, to leave space between buildings. Maybe to add something afterwards. I would pay attention to the flexibility, because it is impossible to do at the first time totally the right. You will need to change things. I do not know in which way but there will be mistakes. You will not be able to imagine the very functioning of the city, the people who live in the city, who will give you the feedbacks. It is also the same thing for learning. Learning for children is to try and make mistakes. You do something. Does it work or not? Does it fit your goal? If yes, you do it like this. If not ok, you try to do something else. When you look at babies learning how to walk. You were like, what are you doing? In fact, they try to find a way to move forward. If they do not succeed, they try something else. But you need to leave space for mistake.

One obvious reason for keeping the plans broad-brush and flexible is that for tasks of complex and uncertain interdependencies, it is impossible to have all necessary information to work out a complete plan *ex ante*. What is more, interdependencies require different parties to communicate and mutually adjust (Edmondson, Bohmer and Pisano, 2001). The deployment of the project thus has to be accompanied by a collective learning process of all members, and the corresponding system-level reflections (Martin and Eisenhardt, 2010). However, to have broad-brush and flexible master plans does not mean have no *ex ante* plans at all. The total lack of *ex ante* planning can easily let the whole system slip to overwhelming expansion and complexity.

A typical example is Flower River project in China. Liqi, the project manager of the project mentioned (translated from Chinese):

We are entirely open. You are welcome to give us advice on what we should do if you want to. We encourage all our partners to work with us to search for the right solutions that can enhance our district (Flower River). Like, the smart access card program, we started with this simple idea. We have this access card for buildings, why cannot we add more functions into it? The program deployed by integrating different stakeholders along the process. The banks, convenience stores... Eventually, this program became... scary. Yes, scary, because it became so complex. I could have never imagined before.

A contrasting example would be the case of River Village. For this case, detailed *ex ante* plans were made not only for the overall project, but also the sub-units as well. All representatives we interviewed told us that they knew exactly what they needed to do before they were invited to the project. However, when asked about how they collaborate with other partners of the project, the representatives looked confused. One of them said:

We did not work with them (other partners). We were hired by the city hall (of River Village). We provide products that fit its requirements. I mean, there are some compatibility issues. Everyone (in the smart city industry) is saying our product is open, our cloud platform is open, but it is not entirely possible. It is a trouble there aren't

widely accepted standards yet in the industry. So we had to contact XXX (another partner of River Village) recently. But, you know, our job is to provide the products to River Village. That is our job.

Why did concrete predefined plans seem to discourage integrative coordination? Our hypothesis is that predefined plans and clear-cut division of tasks decrease participants' perceptions of collective efforts needed, and underestimate the benefits of collective efforts too, even if that is not true in reality. Development in social cognitive theory suggested that people will only engage into a collective action when they believe desired effects can be achieved from collective action (Bandura, 2000). When the perceived benefits were only associated with their individual performance, it was natural that they could not engage with other partners and the project as a whole.

This hypothesis corresponds well with another finding of ours. We discovered that the participants of the well-coordinated projects did not necessarily have shared values or purposes. In the project of V-City, for example, Liu, the project manager representing city hall was mostly concerned with the social benefits of the project, while representatives from private companies aimed foremost economic return, accumulation of experiences, gaining reputation, or expanding market share. However, all participants clearly acknowledged that the realization of these purposes, especially long-term purposes, relied directly on the continuation of collaboration, or successful implementation of the project. One representative of V-City stated, for instance (translated from Chinese):

Our primary goal is for sure economic. There is nothing to hide. Smart city is going to be a large market and all of us know that. The project is a learning process for us, and the experiences we gain can help us to gain future projects. So, we want this collaboration to work and the project to succeed.

Heterogeneity of purposes could cause potential contradictions thus often indicate extensive bargaining in the integrative coordination process. However, as the common ground is for the project to succeed and collaboration to go on, coordination can still be achieved as a dynamic dialectic process. Clearly, participants' self-interests are not necessarily impediments to integrative coordination. As integrative coordination is an enduring process that requires significant efforts from all participants, participants' strong self-interests that are associated with the successful implementation of the project can, in fact, encourage participants to actively engage into the integrative coordination process. As a representative of Smartie said:

We discuss, if there is disagreement, we (are supposed to) vote. But in fact, as every well-written commitment, we did not use those mechanisms. We have a global interest.

Everyone is interested in the fact that the project goes forward. So, each time, we say, ok, since this cannot be decided now, we postpone this topic. And they say, no, we cannot, we have to move forward. Ok, what we do? Ok, I am ok with what you offered. I said no, but go on. I perfectly understand you can go forward. Because of the interest of everyone. So, one time I said, ok, it could be interesting for my company to say no, but since the project

will not go forward if I say no, it is better for me to say yes and to do the project to be able to go forward.

To sum up, when interdependencies are complex and uncertain, it is neither possible nor desirable to have concrete predefined plans. Once the collective tasks are defined by broad-brush *ex ante* plans, a process of collective learning and collective problem solving replaces the process of “planning”. Such collective learning process is driven by the wishes for all participants to realize their long-term self-improvements that are tied to the success of the collective tasks.

Proposition 2: Broad-brush ex ante plan, followed by a dynamic process of collective learning and problem solving, is beneficial to facilitate integrative coordination, when interdependencies are complex and uncertain.

Managing Emergent Order with Semi-structures

Unlike the structural view that magnifies the significance of a central controller, complexity theory emphasizes the emergent nature of macro-level structures and order. It pointed out that system often sacrifices certain degrees of accuracy and efficiency to gain a better chance to survive in the evolutionary process. The optimal state is not equilibrium but an “edge of chaos”, where order is in place yet the whole system is constantly in danger of falling into parts. As Galunic and Eisenhardt argued in their 2001 paper, managers have to apply the right

constructs to keep the system from “slipping into the rigidity of too many rules or the chaos of too few”. (Galunic and Eisenhardt, 2001: 1245)

We have already argued that when interdependencies among tasks are too complex and uncertain, ex-ante coordinative mechanisms, such as predefined plans, are often difficult or too expensive to establish. Indeed, the layered distributed system we observed demonstrated strong reliance on emergent order just like the complexity theory indicates. Organizational activities were selected instead of designed through nonsimple interactions among all subsystems and the system. Yet the question is, just what are the “right” constructs that can facilitate order to emerge from complex interactions without harming vitality of all subsystems and the system as a whole?

Our empirical data pointed to a variety of “semi-structures”. The term “semi-structure” was first anchored by Brown and Eisenhardt in their 1997 paper “The Art of Continuous Change: Linking Complexity Theory and Time-paced Evolution in Relentlessly Shifting Organizations”. In search for constructs that enable organizations to continuously change while maintain coordinated, the authors conducted inductive empirical research on six companies in the computer industry. They discovered that the organizations excelling in continuous change usually applied semi-structures, such as responsibilities, project priorities, time intervals between projects, to endow organizations with some proscribed features, while left enough room for members to act independently and interactively. Eisenhardt furthered this theoretical construct in a number of her later papers. Bingham and Eisenhardt (2011), for instance, pointed out the importance of another kind of semi-structure, heuristic “simple rules”, as building blocks of organizational capability. Other researchers have also noticed semi-structures in a variety of alternative forms. Okhuysen and Waller (2002) conceptualized time pacing as a semi-structure that “increases flexibility for addressing ambiguous tasks” (Okhuysen and Waller, 2002: 405). In

a multi-method research of a hospital emergency department, Valentine and Edmondson (2015) observed how a semi-structure they termed “team scaffold”, i.e., a set of bounded roles with collective responsibilities, provided great support to group-level coordination in fluid groups.

In our better-performing cases, semi-structures were widely applied. The most commonly used are semi-structures that provide certain temporal structure to the interactions among subsystems and systems. Such semi-structures were key organizational components for the cases of Smartie, V-City, Flower River and River Village. In the case of Smartie, for example, the project manager of V-City especially emphasized the crucial role of certain “milestones”, as he called them, in helping the project stay in a dynamic process of integrative coordination. He said (translated from Chinese):

In fact, it was only negotiation with one another, up to now, I would say, we were able to have a decision among all of us. And one factor that can help to go to decision is to have key points, milestones, of the project, that serve as a constraint for everyone. For example, we have a press conference. We have to agree on the message that we want to deliver during this conference. Maybe you have discussion until the night before the conference, but it is tomorrow the conference, so, what do you do guys? We cancel the conference? No. Ok, then we go forward. So, Milestones are very important. When there is a milestone, you can converge with everyone. We need to do that. We need to find a solution all together or else we cannot do it. But since everyone wants to do it, let's find a solution.

For the two lesser cases, Lakeside and Business-U, it was not that those projects did not have any time frame, but neither of them applied time as a tool to organize their work and in-process interactions. In the case of Lakeside, for example, the project manager described their coordinative process as “doing the best when the time comes”. As a result, what we observed was irregular intervals for meetings and “soft” deadlines that were expected yet hardly respected. In the case of Business-U, as the tasks was mostly decomposed and subcontracted, no collective clock was applied for the overall organization. Subtasks deployed with their own cycle of time, and a central project manager served as a hub to assign and coordinate work.

Except for temporal semi-structures, we also observed other kinds of interesting semi-structures that provided guidance to coordinated efforts. The project of V-City, for example, set up a digital board where project managers could post task stencils. These task stencils drew out rough lines about the tasks, the key problems, interdependent relations, and collective responsibilities. Participants could fill out or adjust these stencils according to their knowledge and expertise. These task stencils were not plans or regulations, however, they coordinated collective in a fluid manner, thus were highly valuable especially when interdependencies were complex and uncertain. As one of the project manager of V-City stressed (translated from Chinese):

Different partners have different experiences, and people have different degrees of familiarity with the tasks. With the task stencils as a guidance, people can know, more or less, what types of work they need to do, how many stages there would be, what are the key points, where should they put the emphasis... All these will be clear. This is one purpose of having these

task stencils. And secondly, this stencil is a kind of constraint, because different partners have different capabilities, and with this tool, people's understandings and behaviors can be better aligned. So we use this tool to provide flexible and clear boundaries.

Unlike formal structural designs or coordination mechanisms, process-oriented formal semi-structures do not provide a way of “control”, but rather a chance of “mutual adjustment”. These semi-structural elements can be categorized as tools that define the “feedback loops” in complexity theory. Time-paced semi-structures, such as the “milestone” applied by Smartie, forcefully defined the end of one loop and the beginning of the coming one. Clear definition of those feedback loops helps the smooth deployment of integrative coordination process in at least two main ways. First, all participants thus have a common “time unit”. In other words, they work on a same clock. This common “time unit” is crucial in enhancing predictability and accountability of coordinated efforts. Second, such process-oriented semi-structures offer coordinating groups a chance to pause what they were doing respectively, and check if they have moved closer to their collective goals or not. Such evaluations help participating groups to self-coordinate their integrative efforts and facilitate a mutually adaptive co-evolutionary process. As a representative in the V-City project mentioned:

I believe a key to our success (in coordination) is the monthly meetings we had. Not the emails and all that, but really the face-to-face meetings. At the beginning, you know, we do not know what others are doing. We do not know each other's business, so we are afraid. When you are forced to meet, you understand what others were doing, how they

move. I would say there was a sense of competition even. People do not want to be seen as the one who is lagging, the one who stopped the project from achieving its periodical goals... It (the meeting) even helps ourselves, you know, to see, oh, we did well here, but not there, oh, we need to work harder so that we will be in time for XXX (another participating company's name).

Thanks to semi-structures, organizational members could have a chance to adjust their work to fit better the project's requirements and fit better the work of other groups. In case of conflicts or indecisiveness, these semi-structures also facilitate decision making, thus making sure the project will move forward. With complex and uncertain interdependencies, it is important to have coordinated actions while allowing room for different parties to realize their own autonomy and involve into a collective learning process. Thus, semi-structures served an important role in facilitate and maintaining the "edge of chaos".

Proposition 3: Semi-structures are effective organizational arrangements to facilitate integrative coordination, when interdependencies are complex and uncertain.

Table 3: Overview of the Organizational Dispositions of All Cases

Name	Layered Structure	Distributed Subsystems	Planing Process	Semi-Structures
V-City	Yes <i>"The board has the final say on major decisions."</i>	Yes <i>Specialized yet interactive and overlapping project teams under the board</i>	Emergent with collective responsibilities <i>"Smart city is totally new. We learn together in the process of building it. That is our common goal."</i>	Yes <i>Time pacing; Periodical meetings; Task stencils</i>
Flower River	Not clear <i>"The negotiation process can be long, as no one could convince others easily."</i>	Not clear <i>"We involve more partners into our project along the way."</i>	Mostly emergent <i>"We are entirely open... We encourage all our partners to work with us to search for the right solutions"</i>	Yes <i>Time pacing; Task priorities</i>
Lakeside	No <i>Three decision-making bodies worked in parallel</i>	No <i>"We have been idled for two years. XX should gave us the masterplan. They are too slow."</i>	Concrete predefined plans endeavored <i>"The XX are responsible for making the master plan. So, now we have nothing to do. We want it to move fast, but we need to wait for the plan."</i>	Not observed
Smartie	Yes <i>A consortium with ten working groups under it</i>	Yes <i>Ten working groups worked simultaneously with rich interactions.</i>	Emergent with collective responsibilities <i>"We spent six months to make this master plan together." "Smartie is a collective learning process... We focused on the problem solving."</i>	Yes <i>Time pacing; Periodical meetings</i>
River Village	Yes <i>"The city hall is our client. Tasks were assigned to us</i>	No <i>There was a modular structure but autonomy and interactions among modules were weak.</i>	Concrete predefined plans <i>"We did not attempt to move on too fast. We really spent extensive time and energy in making sure our plan is the best."</i>	Yes <i>Time pacing; Responsibilities</i>
Business-U	Yes <i>"XXX is clearly the general contractor."</i>	No <i>The tasks were subcontracted to participating organizations.</i>	Concrete predefined plans <i>"Of course we made clear masterplans beforehand. That is required for smooth operations."</i>	Not observed

Discussion

In this paper, we endeavored to answer the research question: *what facilitates an ongoing integrative coordination process when interdependencies are complex and uncertain*. This question has extraordinary significance, not only because in an information age, the complexity and uncertainty in interdependencies are increasing, but also because such integrative coordination allows us to tackle problems of larger purposes beyond economic gains. Like our

empirical setting indicates, information technologies enable us to offer urban solutions that can create a more efficient, agreeable, energy saving, and socially inclusive working and living environments. However, the realization of those ambitious social purposes requires the collective efforts of a variety of individuals and organizations, thus demands better integrative coordination.

This paper contributes to the process-theory about integrative coordination. Although structural theory, social network theory and complexity theory are often treated as competing theories in guiding integrative coordination, this paper showed that their explanatory power is, in fact, complementary. Innovative organizational arrangements, such as layered-distributed structure, and semi-structures, can realize organizational benefits that were traditionally regarded impossible to exist at the same time.

In this paper, we raised three propositions that relate organizational arrangements with integrative coordination processes with complex and uncertain interdependencies. However, the search for those organizational arrangements should not stop here. By synthesizing our findings, we observed some common underlying traits that may serve as directions for future research. First, the next generation of organizing has to pay much more care to participants' sense of autonomy. That is probably why we observed that differences in roles facilitate coordination yet status differences harm coordinative process; Second, coordinated integration will be achieved by participants' internal drives, not by pre-set common goals. Social purposes are realized by respecting and managing people's internal drives to gain, to learn, to cooperate, to create, instead of by being imposed. Third, even if the goal is to achieve integrative coordination, the overall system has to leave some room for mistakes and external shocks. This might be why distributed and semi-structural arrangements should be paid more attention to.

CHAPTER 4:

Ordered Disruption: A key to balance collective creativity and coordination

ABSTRACT

When the examination of creativity moves from individual level to collective level, the intrinsic tension between creativity and coordination in organizations becomes more salient. Is it possible to balance creativity and coordination in an organization? If so, what kind of organizational arrangement can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency? By conducting a multiple case study on four smart city projects, this paper proposes that “ordered disruption” is an effective tool that can promote collective creativity without harming the coherence of an organization. This paper identified three major types of “ordered disruption”: (1) ordered temporal disruption; (2) ordered spatial disruption; and (3) ordered affective disruption.

Keywords:

Collective creativity, ordered disruption, ordered temporal disruption, ordered spatial disruption, ordered affective disruption

Introduction

A large body of existent research on creativity is on the micro level (Shalley et al., 2004). Creativity has been mostly treated as an attribute of individuals rather than an attribute of collectivities (George, 2007). Resultantly, rich literature has been generated on the effects of personal characteristics, such as motivation (Amabile et al., 2005), personality (Feist, 1998), or demographic variables (Tierney and Farmer, 2002) on individual's creative performance; or, the effects of contextual factors, such as job design (Hatcher et al., 1980; Oldham and Cummings, 1996), network structure (Uzzi and Spiro, 2005), or leader-employee relationships (Janssen, 2000, 2001) on individual creativity.

While individual insights are undeniably important, researchers in recent years began to look beyond within-individual internal processes (George, 2007). More and more attention is called for to advance understandings on collective creativity (Shalley et al., 2004; George, 2007). Such change in academic interests coincides with the rise of the applications of information technology, and the corresponding increase in the complexity of the problems human beings can and want to tackle. It is becoming increasingly rare for any individual to possess the necessary knowledge, expertise, skills, or the insights, to be able to creatively solve those complex problems alone. The accomplishment of such complex tasks requires knowledge and expertise from a variety of disciplines and perspectives (Bissola and Imperatori, 2011). As creative insights often come from the confluence of existing ideas (Hargadon and Bechky, 2006),

creativity increasingly comes from collective efforts. Although related, individual creativity and collective creativity are two distinct phenomena. Collective creativity is not the aggregate creativity of all organizational members (Taggar, 2002). It comes from “mindful interactions of participants in the problem-solving process” (Hargadon and Bechky, 2006: 487), and deserves attention from management scholars.

However, research in organizational science on collective creativity is still at its early stage. A number of review papers on creativity have expressed wishes for more theoretical and empirical work on this topic. In the review paper of Shalley, Zhou and Oldham (2004), the authors concluded that the majority of earlier research on creativity focused on “antecedents of individual employee creativity” (p. 951), while little research is done on collective creativity. George (2007) made similar conclusions. He proclaimed, “what is most striking about the literature on group creativity is how much we currently do not know about the creativity of ongoing groups in organizations” (p. 466). Obviously, it is high time for management researchers to contribute more to the theorizing and empirical work on collective creativity. In the information age, collective creativity is essential for the advancement of human knowledge and skills, and is a key drive for complex problem solving. There are many interesting and important research questions waiting to be answered.

When the examination of creativity moves from individual level to collective level, the intrinsic tension between creativity and coordination in organizations becomes more salient. For any collective group to be a “group”, some degree of togetherness is needed. Group members need to coordinate their efforts by providing accountable and predictable work, and by sharing certain common understandings (Okhuysen and Bechky, 2009). However, creativity by definition is not predictable, and the moments of collective creation come with the recombination

of diverse ideas, knowledge, and perspectives (George, 2007; Hargadon and Bechky, 2006). In other words, collective creativity, on one hand, relies on coordinated efforts; on the other hand, it emerges from the interactions of differences, contradictions, or even conflicts (Choi and Thompson, 2005; Runco, 2004). This intrinsic paradox between the need to make coordinated efforts and the need to have divergent minds to interact creatively is a question that organizational researchers cannot ignore.

Is it possible to balance creativity and coordination in an organization? If so, what kind of organizational arrangement can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency? These are the research questions this paper intends to tackle.

Due to the limited theoretical and empirical literature on collective creativity, this paper takes a theory-building approach (Eisenhardt, 1989b; Eisenhardt and Graebner, 2007). The empirical setting is four smart city projects. By conducting within-case and cross-case analyses, this paper proposes that “ordered disruption” is an effective tool that can promote collective creativity without harming the coherence of an organization. This paper identified three major types of “ordered disruption”: (1) ordered temporal disruption; (2) ordered spatial disruption; and (3) ordered affective disruption.

Theoretical Background

Two streams of previous research can assist us to answer our research questions. Foremost, there is the literature on collective creativity. Although this stream of research is still young, interesting theoretical and empirical efforts have been made. Moreover, there is rich

knowledge to help understand the balance between collective creativity and coordination in an organization. Albeit lots of the research did not address this problem directly, extensive work on organizational tradeoffs can shed light on the question concerned. The answers to our research question lie at the intersection of both of these two research domains. In the following part, a brief review will be given on both of these two topics.

Collective Creativity

Some researchers believed that collective creativity was the aggregate of individual creativities. Pirola-Merlo and Mann (2004), for example, held the view that the relationship between individual and collective creativity was rather simple. They admitted that creativity could occur by separate individuals, and could also occur through the interactions of a group of individuals. However, they regarded such interactions as stimulators to individual creativity. In their words, “creative contributions can still be attributed to specific individuals” (Pirola-Merlo and Mann, 2004: 238). Using a sample of 54 research and development teams, the authors showed that collective creativity at a particular point in time could be explained as either the average or a weighted average of team member’s individual creativity.

Many other researchers, however, held the view that collective creativity was a phenomenon distinct from individual creativity, and deserved special attention from organizational scholars. The relationship between individual and collective creativity was non-simple. Reasons to support this view could be synthesized into the following three aspects.

First, certain collective cognition exists beyond individual cognition. This point of view is consistent with the literature on “collective mind” in organizations (Weick and Roberts, 1993),

which is “distinct from an individual mind because it inheres in the pattern of interrelated activities among many people” (Weick and Roberts, 1993: 360). The shared cognition of a group can be reflected by its collective knowledge systems, emotional and motivational systems, and communication and behavioral systems (Thompson, 1999). One stream of research that originated from psychology but strongly influenced organizational research in collective cognition is the research on transactive memory system (TMS), which suggests that organized individuals can develop a collective transactive memory about how information and knowledge is distributed in a group (Wegner, 1987; Lewis and Herndon, 2011; Hirst and Manier, 2008). Numerous researches have shown evidence that such collective transactive memory systems contribute to the overall performance of an organization, especially creative performances (Argote and Ren, 2012; Hsu et al., 2012; Chiang et al., 2014). As the functioning of this transactive memory system relies on the interdependence of members, such system and its related cognitive processes are collective in nature, rather than individual. Accordingly, creativity that generated with those systems and cognitive processes also has disparate determinants and mechanisms from individual creativity.

Second, unlike individual creativity, collective creativity, by definition, involves a group of people. Thus, the composition of this group would have an influence on the collective creativity performance. One of the most prominent streams of research from the compositional perspective is about how member heterogeneity affects collective creativity. In their 2005 review paper “What Differences Make a Difference? The promise and reality of diverse teams in organization”, Mannix and Neale synthesized and advanced this long academic discussion. They pointed out that previous researchers had injected too broad connotations to the word “diversity”. Basically, it means “any attribute that another person may use to detect individual differences”

(Williams and O'Reilly, 1998:81; *c.f.*, Mannix and Neale, 2005: 31). However, diversity is a complex phenomenon. Different types of diversity might lead to different collective performances through different mechanisms. They categorized diversity along factor approach (e.g. visible and invisible differences of individual members) and proportion approach (e.g., the proportion of certain minority/majority members). The authors concluded that surface-level social category differences tend to have negative effects on collective creativity because they may hinder social integration and communication; while underlying differences, such as differences in education, personality, etc., tend to facilitate collective creativity, thanks to the larger knowledge pool they bring.

The third disparity between individual and collective creativity is about the processes through which they emerge. The emergence of individual creativity is a within-individual process, albeit this process can be influenced by contextual factors, including group interactions. Collective creation, however, always emerge across the interaction of individuals (Hargadon and Bechky, 2006). As a result, special emphases were given to understand the interactive processes amongst group members in the literature on collective creativity.

Taggar (2002), for example, identified “team creativity-relevant processes” through an empirical study of 94 groups on 13 different open-ended tasks. He argued that these processes moderated the relationship between individual and collective creativity. Taggar’s research recognized the importance of those collective creative processes, yet it did not explain through what mechanisms those processes lead to collective, rather than individual creativity.

Other researchers addressed this theoretical gap. An important contribution of Mannix and Neale (2005)’s paper is that they summarized three theoretical approaches, i.e., similarity-

attraction theory, social identity and self-categorization theories, and information-processing and problem-solving approaches, to guide their analyses on how diversity affects collective creativity. All of these three theoretical approaches point to certain process effects that are pertinent to interactions among group members, especially on communication, information integration and coordination, which are crucial for collective creativity to emerge.

Hargadon and Bechky (2006) pointed out that collective creativity does not solely rely on each individual's cognitive skills, because when a group of individuals gather to solve a problem, the interpretation of that problem and the perspective applied to look at that problem are shaped by collective processes. Following this perspective, the authors focused on examining the “moments of collective creativity”, i.e. the moments when mindful interrelations among individuals lead to collective, rather than individual insights. Using six consulting firms as their cases, they found that four types of behavior patterns are especially pertinent to moments of collective creation: (a) help seeking, (b) help giving, (c) reflective reframing, and (d) reinforcing.

The recent work of Paris and Lang (2015) presented similar findings from their empirical research on perfumery and haute cuisine industries. They discovered that creativity in those industries is not the results of gifted individuals, but rather collective processes. They proposed a four-stage process of this collective creation process: inspiration, framing, formulation and validation.

To summarize, the emergence of collective creativity has distinctive determinants and mechanisms from the emergence of individual creativity. To date, research on collective creativity is still underdeveloped, especially considering how much organizations in the information age rely on collective processes to find creative solutions to the complex and large-

scale problems our society faces. Serious work is needed to advance both theoretical framework and empirical evidence in this research domain. Notably, the interactive processes from which collective creativity occurs are embedded in organizational context, yet very little is known about how governance arrangements affect collective creative processes. Special attention should be paid to this research direction (George, 2007).

Balancing Creativity and Coordination

Organizations are oftentimes built on tensions and contradictions. Scholarly examinations on those tensions and contradictions took a variety of forms, including the tradeoff between exploration and exploitation (March, 1991; Fang et al., 2010), the balance between efficiency and flexibility (Eisenhardt et al., 2010), or between search and stability (Rivkin and Siggelkow, 2003). Those tensions emerge from the simultaneous needs for organizations to remain coherent and coordinated, and to stay alert of the changing environments and provide creative solutions to problems encountered. In other words, there is an innate organizational tension between creativity and coordination. Being creative means having new ideas, raising innovative solutions, and exhibiting original behaviors (Runco, 2004). Such originality is by definition difficult to predict and control, thus would challenge organizational coordination (Okhuysen and Bechky, 2009). In the meanwhile, certain coordination mechanisms, such as rules and routines, tend to lead organizational members and the organization into more and more predictable and homogeneous behaviors, yet creativity, especially collective creativity comes from the constant recombination of different ideas, knowledge, and perspectives (George, 2007; Hargadon and

Bechky, 2006). Thus, in order to understand collective creativity, researchers have to directly face the tradeoff between collective creativity and organizational coordination.

There were two main approaches to counter such organizational dilemma. The first approach was relatively static. It searched for organizational configurations that enabled the simultaneous achievement of opposing needs. This approach was best represented by the literature on “ambidexterity” (Duncan, 1976; Tushman and O’Reilly, 1996; Raisch et al., 2009). In 1991, March published his seminal paper on exploitation and exploration. Since then, academic interest in how to balance the needs of exploiting a firm’s current resources and capabilities while at the same time exploring new opportunities has remained strong. A number of researchers (Duncan, 1976; Tushman and O’Reilly, 1996) proposed the design of ambidextrous organizations and suggested that those organizations exhibited higher performance (Raisch et al., 2009; O’Reilly and Tushman, 2013). Along time, the term ambidexterity went beyond the discussion about exploitation and exploration, and referred broadly to an organization’s capability of managing organizational tradeoffs.

Previous literature proposed two main directions for achieving ambidexterity. The first direction is structural ambidexterity (Gibson and Birkinshaw, 2004; Schreyogg and Sydow, 2010). This direction emphasized “separation” (Eisenhardt et al., 2010), or “differentiation” (Raisch et al., 2009). Under the assumption that different organizational configurations excelled for different purposes, researchers of this direction proposed to design differentiated sub-units to carry out different tasks (O’Reilly and Tushman, 2008; Fang et al., 2010). For instance, mechanical structure could be applied to units that needed to be efficient and stable, while more organic structure could be applied to units that carried out more creative tasks. In this case, the overall organization is able to achieve certain degrees of ambidexterity. Critics on this way of

achieving ambidexterity mostly emphasized the possibility for such separation to cause confusion and confrontation on the organizational level. After all, all units are parts of the same organization. Dramatic differences in their structures and priorities can raise sharp inconsistencies in organizational identity, culture and strategy. To what extent is such separation plausible? There is not any definitive answer to this question yet.

In order to counter the problems of structural ambidexterity, Gibson and Birkinshaw (2004) raised a second direction: “contextual ambidexterity”. They suggest that ambidexterity is best achieved “by building a business-unit context that encourages individuals to make their own judgments as to how best divide their time between the conflicting demands for alignment and adaptability”. Albeit an innovative and insightful concept, some argue that contextual ambidexterity simply push the dilemma from the organizational level to individual level (Schreyogg and Sydow, 2010). What enable individuals to make the wise judgment about when to be creative and when to be obedient? Can individuals really switch between opposing modes smoothly? Would not individuals be subject to organizational inertia and rigidity? There are not any definitive answers to these questions either.

Disparate from the “ambidexterity” approach, a second approach to counter organizational dilemmas focused more on process, rather than structure. Acknowledging the difficulties of having both at the same time, researchers of this stream explored the possibilities of having intermittent periods of one and then the other (Brown and Eisenhardt, 1998; Eisenhardt, Furr and Bingham, 2010). This approach is termed “organizational vacillation” (Boumgarden et al., 2012). In this case, the key is no longer about having a balance between opposing needs, but about managing the continuous balancing process. It was argued that, as organizations tended to adopt certain practices while ignoring the alternatives, it was important to have second-order

activities to constantly scan external environment and the internal developments, in order to find the mismatch, select the most appropriate organizational configurations, and adjust organizational practices (Nickson and Zenger, 2002; Schreyogg and Sydow, 2010). This is a balancing process similar to the double-loop learning proposed by Argyris (1976). Eisenhardt, Furr and Bingham (2010) even argued that, since organizations tend to favor routinized coordination with the instituting process of organizing, the balancing process should be, in fact, an intentional unbalancing process favoring creativity.

Compared with the ambidexterity approach, the process-oriented “organizational vacillation” approach is more dynamic, and it deals with the balancing problem on the level of organization, instead of pushing the problem to sub-units or individuals. Those advantages make this approach well worth further investigations. However, the realization of organizational vacillation is still a challenging task. Apparently, the second-order mechanisms can only be effective when the organizations are still flexible enough to adjust. In this case, are researchers supporting the “organizational vacillation” approach chasing their own tails, in the sense that they simply transformed the dilemma between coordination and creativity into the dilemma between organizational rigidity and flexibility? Furthermore, environment is not either stable or dynamic. It is multi-dimensional (Eisenhardt et al., 2010). As a result, even at a given point in time, organizations may not have the luxury of selecting between coordination and creation. Simultaneity does have its significance.

The review above briefly synthesized current theoretical advancements on collective creativity and on how to balance coordination and creativity in an organization. Clearly, all organizations face some degrees of tradeoffs and contradictions. On one hand, the process of organizing is a process of structuration and institutionalization. Organizations need to enable

coordinated efforts in order to deliver reliable and predictable performances; on the other hand, organizations are subject to constantly changing environment, thus need to come out with creative solutions for new problems encountered. The governance arrangements applied to deal with such intrinsic tradeoff significantly affect the process of collective creativity in those organizations. However, research that studies the relationship between such governance arrangements and collective creativity is still lacking. This is the theoretical gap this paper intends to address.

Method and Empirical Setting

Due to the limited theoretical and empirical literature, this paper takes a theory-building approach (Eisenhardt, 1989b; Eisenhardt and Graebner, 2007; Edmondson and McNamus, 2007). We made a multiple-case study upon four collaborative organizations on smart city projects, two of which in China and two in Europe. Smart city is a fairly new concept. A city, or a district of a city, is considered “smart” when solutions for disparate aspects of urban life, such as energy, water, waste treatment, transportation, are tackled as an interactive system enabled by big data analytics and ICTs (Information and Communication Technologies). By integrating data and information from various aspects into a shared platform, cities can be more efficient, convenient, agreeable, environmental friendly and inclusive. In short, they can be “smarter”. Surrounding smart cities, a new industry is burgeoning. Public agencies and private firms alike are searching actively new solutions to improve urban life. This brand new industry requires not only the development of related new technologies, but also knowledge about innovative business models for its organization and financing. As the realization of such a large-scale systemic task depends

on a wide diversity of expertise, the development of smart cities is really a massive collective creation process, thus makes this industry a perfect setting for our research purpose.

Although the research question of this paper concerns both collective creativity and coordination, the focus of this paper is nonetheless on collective creativity. We are interested in discovering governance arrangements that can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency. In order to better our chance of having relevant findings, we only chose cases that performed well in integrative coordination, yet has differentiated performance in collective creativity. In another paper of ours, “Herding Cats: Deciphering integrative coordination process in the information era”, we studied six cases of collaborative organizations on smart city projects. Those projects were identified with the assistance of Digital City Engineering Research Center of the Ministry of Housing and Urban-Rural Development of China, and the Global Advisory Committee of the Smart City Expo Barcelona. Among these six cases, Smartie and River Village in Europe, V-City and Flower River in China performed better in integrative coordination (see detailed evaluation methods in the paper “Herding Cats”).

We assessed the level of collective creativity of these four collaborative organizations qualitatively with the following three methods. First, we evaluated the innovative outputs of these four cases. These innovative outputs not only included patents gained during the project, but also creative problem solving observed by researchers or mentioned by interviewees. Second, we interrogated external experts about their perceived level of collective creativity of the focal projects. The questions asked were like: “Did this project raised solutions that were distinctive from other projects?” “Did you observe intentional endeavors to probe into the future?” “Did you observe attempts to combine different expertise to solve a focal problem?”, etc. The better cases

were indicated by answers like, “This (case) is among the better ones. Liu (the project manager) is an active person and always push the team to search for the best.” “What I appreciated most is that they really paid attention to accumulating and analyzing their experiences so as to make sure they build up the business model for tomorrow.” The lesser cases were indicated by answers like, “It’s a good project but I cannot think of anything particularly creative now.” “I would say they do things orderly, and in the square.” The third method is interrogating project managers in those cases. As they are the ones most familiar with what went on, they are a reliable source about the collective creation processes (Gilson and Shalley, 2004). Except for asking them to evaluate the collective creativity of their respective cases, we also asked them to describe the collective creation process they experienced. The better cases were indicated by descriptions like, “Of course! Whenever people need help from another working group, they just ask. And in our monthly meetings, people will meet up and everyone will contribute to solve problems raised there.” “Sometimes it’s the insight that matters the most. For the design of this carriage for example, it was X, a manager, who had this idea of lowering the plate to gain space and stability. And Y, our chief engineer turned this into reality in only two months.” The lesser cases were indicated by descriptions such as, “We would like to be creative, but it was very difficult. Things could go messy.” “We are not engineers. Our partners provide us with innovative solutions. Our job is to give them clear requests.” After synthesizing the investigations, we identified Smartie and V-City as the two cases that exhibited higher levels of collective creativity; and River Village and Flower River lower levels.

Table 4: Levels of Creativity Exhibited

Name	Creative Performance	Creative Outcomes	Quotes from External Experts	Quotes from Project Managers
Y-City	High	A highly integrated smart card system; Advanced traffic management system; Localized smart governance system	<p>"This (case) is among the better ones. Liu (the project manager) is an active person and always push the team to search for the best."</p> <p>"They did not simply adopt a solution. They localized it creatively."</p>	<p>"It was X, a manager, who had this idea of lowering the plate to gain space and stability. And Y, our chief engineer turned this into reality in only two months."</p>
Flower River	Low	Creative solutions were attempted but the rate of success was low; Problem-solving process was hardly collective.	<p>"It's a good project but I cannot think of anything particularly creative now."</p>	<p>"We would like to be creative, but it was very difficult. Things could go messy."</p>
Smartie	High	Highly innovative smart grid installed; Experimental electricity storage project; Innovative energy saving plans.	<p>"What I appreciated most is that they really paid attention to accumulating and analyzing their experiences so as to make sure they build up the business model for tomorrow."</p>	<p>"Of course! Whenever people need help from another working group, they just ask. And in our monthly meetings, people will meet up and everyone will</p>
River Village	Low	Installation of mature smart governance systems; Little cross-sectional communication and creation spotted.	<p>"This project went smoothly and has won quite some honors. I would say they do things orderly, and in the square."</p>	<p>"We are not engineers. Our partners provide us with innovative solutions. Our job is to give them clear requests."</p>

All the four cases were on ongoing smart city projects with lasting organizational structures. All projects were on one specific district of a city, except for the case of River Village, which was a citywide project. The projects were 3 to 7 years of age, and were in the full swing of operation. All of these four cases involved inter-organizational collaborations (5 to 10 major partnering organizations). In all four cases, certain organizational structures were established to manage the projects. Roughly, we divided the organizational members into two categories. One was project manager. It was their responsibility to manage the advancement and performance of the overall projects. The other category was project participants. In our cases, these were typically the representatives of industrial partners of the project. In this paper, they were referred to as “representatives”. It is worth noticing that in some of the cases, one organizational member served multiple roles in a project, in those cases, we labeled them according to their most salient role. According to this categorization, we identified three types of informants for this study: the project managers, the representatives, and external experts.

Table 5: An Overview of the Cases

Name*	Location	Starting Year	Project Focus	Number of Major Partners	Informants Interviewed	Informants Interviewed by Type
V-City	China	2010	smart governance and services	8	10	Project manager: 3 Representatives: 6 External Expert: 1
Flower River	China	2009	smart services	7	8	Project manager: 3 Representatives: 5 External Expert: 0
Smartie	Europe	2012	smart energy and services	10	11	Project manager: 5 Representatives: 5 External Expert: 1
River Village	Europe	2008	smart governance	6	9	Project manager: 2 Representatives: 6 External Expert: 1

* All the names were pseudonyms for the reason of confidentiality.

** Several informants were interviewed more than once.

Data collection

We utilized both first-hand and second-hand data for our research. First-hand data was mainly collected by face-to-face interviews. Some follow-up data were collected by telephone calls and emails. We also relied on second-hand data such as press releases, internal documents and online materials. The diverse sources made sure that we collected as much information about the cases as possible and triangulation helped to boost data accuracy and the robustness of our propositions. Overall, we made 42 semi-structured interviews in a period of eleven months. We asked the informants three categories of questions. First, we asked them to provide background information about their project, especially the objectives, maturity, scale, resources, and participating organizations. Second, we asked the informants to describe their role in the project and their relationships with other key players in the projects. Third, we asked them to describe how the project deployed, especially how innovative solutions were developed. Both open- and closed-ended questions were raised. However, we did not ask any questions that would lead our informants to predefined judgment. Follow-up questions were raised when the informants' answers were brief or especially informative, yet those questions stayed strictly neutral.

In order to collect unbiased data, we made sure that for each case, we interviewed key stakeholders with different roles: project managers, representatives from participating organizations, and external experts. We interviewed only informants who were highly knowledgeable about the case. We used "courtroom questioning". All the questions are factual. We informed all our informants before the interview started that all the information collected

would and would only be used for academic research and their names, the names of their company, and the names of the smart city projects under investigation would be kept anonymous.

Data Analysis

We took a ground theory-building approach, thus no hypotheses was raised before data analysis. Following the procedures advised by Eisenhardt (1989b), we conducted within-case analyses first. We constructed numerous write-ups by synthesizing the information collected from different sources. Initial analysis was made to form concepts and constructs pertinent to collective creativity. In this phase, we wrote as many write-ups as possible to maximize the scope of our search for possible theoretical explanations. All write-ups are emergent from the data we collected about the cases.

We then made cross-case analysis to identify the initial propositions of this paper. After within-case analyses, we first compared the two cases with high collective creativity performance, in order to identify similar features and practices. Then, comparison was made between the two cases with low performance. Later on, we analyzed the Chinese cases together. Similar analysis was conducted for the European cases as well. Lastly, we used random pairing technique to examine the validity of our findings.

After this round of data analysis, we went through previous literature to search appropriate theories that could explain the data we collected and initial propositions we found. Some propositions were modified with the theoretical insights provided by previous research and new propositions emerged at this stage as certain theories led us to examine the data we collected with alternative approaches. Those propositions turned out to have a good fit with our data.

Existing literature also allowed us to make sense of our emergent findings and helped us to re-organize our propositions into a consistent theoretical framework.

Following the replication logic of multiple-case study method (Yin, 1994), we tested our propositions repeatedly with each and every case. Only theoretical relationships with a strong fit with all cases were kept and the weak ones, or the ones inconsistent with some cases were discarded. The resulting propositions and theoretical framework are strongly supported by our data and some of the previous theories as well. We present our findings in the following part of this paper.

Achieving Balanced Collective Creativity with Ordered Disruption

Before presenting our findings, we would like to stress that the aim of this case study is not about evaluating the creative outcomes of these collaborative organizations. Our goal is to observe the creative problem-solving process and find out what are the governance arrangements that facilitate such processes. That being said, in this paper, the emergence of collective creativity is understood as an interactive process (Taggar, 2002; Harvey, 2014). We define collective creativity as the process of generating new and useful solutions to problems, by recombining existing knowledge and resources (Hargadon and Bechky, 2006). With this definition in mind, we discovered that an interesting construct, which we termed “ordered disruption”, could serve as an effective tool to promote the emergence of collective creativity without harming the coherence of an organization.

Basically, ordered disruptions refer to arrangements that lead to orderly, instead of ad-hoc, disruptions to the interactive patterns among organizational members. According to the

differences in the objects of such disruption, this paper identified three major types of “ordered disruption”: (1) ordered spatial disruption; (2) ordered temporal disruption; and (3) ordered affective disruption. In the following part, we will explain each of these three types of ordered disruptions in detail.

Ordered Spatial Disruption

In this paper, spatial arrangement does not only refer to physical space, but also refers to organizational clustering and virtual spaces. Research on the relationship between spatial arrangements and collective creativity is not abundant. However, if we understand the emergence of collective creativity as an interactive process that recombines existing knowledge and resources, spatial arrangement is no doubt a key variable that influence the form and performance of such interactive processes.

One especially intriguing aspect of spatial arrangement pertinent to collective creativity is about spatial density. Dense spatial arrangement can potentially increase the chances for people and ideas to meet and interact. Proximity and the resultant familiarity facilitate organizational coordination thus enable strong collective efforts in generating and implementing creative solutions. Such advantage is especially salient for creatively solving complex problems, which requires in-depth integration of various knowledge and expertise (Uzzi and Spiro, 2005; Granovetter, 2005). However, high spatial density can also indicate organizational homogeneity and institutionalized constraints that decrease the chance of generating new ideas. Obstfeld (2005) referred this feature of high spatial density as the “idea problem” (p. 101). Sparse spatial arrangement, on the other hand, may allow individuals’ attention to better focus on the work

itself (Shalley et al., 2004) and present higher degree of diversity among organizational members (Burt, 1992, 1994; Obstfeld, 2005). Such advantage provides a richer field for innovative ideas to occur and higher chance for effective knowledge combination in generating new solutions. In the meanwhile, low spatial density raises the “action problem” (Obstfeld 2005: p. 101), i.e. dispersed people are more difficult to mobilize and coordinate; yet in-depth communication and coordination is indispensable for collective creativity. It is difficult to weigh between the negative effects of “idea problem” and “action problem”. This dilemma in spatial arrangement reflects the more general contradiction between collective creativity and coordination discussed earlier. Similar tradeoffs exist for other spatial arrangements, such as boundary settings (Oldham, Cummings and Zhou, 1995; Shalley and Oldham, 1997) as well.

Our case study provided intriguing clues on how to counter such dilemma. As smart city projects are extremely complex systemic tasks, which require expertise from a large range of highly professional industries, those collaborative organizations were all inter-organizational organizations, joining efforts from a variety of public and private entities. In all of the four cases, the collaborative organizations applied certain modular structure. These modules were dense clusters formed by one or more partnering organizations. Each of these sub-system level modules focused on certain aspects of the smart city projects. Interestingly, the two cases that performed better in collective creativity, i.e., Smartie and V-City, both applied special governance arrangements that disrupt such dense clusters.

For example, in both of these two cases, there existed certain degrees of overlapping among modules, i.e., some members of one module served as members in other modules as well. On one hand, the modules were dense clusters with clear boundaries; on the other hand, the overlapping in membership disturbed the boundary and identity of such dense clusters.

Considering that each module was relatively independent and with differentiated tasks, such overlapping not only injected diversity into modules, but also provided a permanent force that kept the dense clusters from slipping into a rigid cohort. As long as there were to be differences in the evolutions of these modules, overlapped members would detect such differences and disperse such differences to various groups they belonged, thus potentially enhanced the collective creativity in such groups.

Smartie, for instance, was an ambitious project led by a private real estate developer, Bliss Real Estate, and participated by nine other industrial leaders from different industries. The aim of the project was to take advantage of Internet of Things and big data analysis to optimize energy production and distribution, provide better social services and enhance the inclusiveness of community life. In order to carry out this complex project, a consortium was formed as an organizational framework to manage the project. Under the consortium, there were ten working groups. Each of these working groups was led by one of the ten industrial partners, and participated by another one or more industrial partners. Within each of these working groups, people worked very closely together, both physically and virtually using digital communication tools. Such dense clustering and in-depth interactions provide the necessary ground for meaningful integration of various knowledge and perspectives. As Edward, the leader of aggregator optimization working group said:

We formed a team (the aggregator optimization working group). At some point in time, it is the company, but also the people. I mean, if you want to have a stable group of people, being able to work together, then things can move. We need to communicate and share. People from

large companies could be reluctant to do that at the beginning. However, as we said, there is also the people work. People eventually want to learn from each other and to progress.

However, as each industrial partner was member of a number of working groups, such overlapping brought in certain disruptions to such dense clusters that kept the clusters from solidifying and provided extra diversity to the clusters. Such effects have been observed to have a positive impact on collective creativity. As the leader of energy production working group described:

We (the company he represented) are a leader (in photovoltaic energy production). For that, we do not need help from others. The interesting thing about Smartie and how it works is that now I have people from residential buildings, commercial buildings, IT, etc., who really work in the same group with me. We have to communicate with them and that is interesting because it guided the work to a wider perspective than a purely technical perspective. They are good I think partly because they are involving us into B2C mode, not just B2B. B2B you speak to engineers. B2C you speak to the clients, the people, the end users. They drove innovation for us and avoid us from fighting only on price level. They are the ones who bring differentiation on that.

Similar benefits were observed in the case of V-City as well. As the project managers and participating firms of V-City project understood the interconnectedness among sub-tasks,

membership overlapping was universally developed among various project teams (similar to working groups in Smartie). One of the experts who was included in both the urban planning and smart traffic team acclaimed (translated from Chinese):

I would stress this is not the urban planning we knew. Not the planning one learnt at school. I never worked with IT people before when I make the planning work, and to have that simultaneously did make some differences. At some point I thought, why would they think like that? They really did not understand planning! They thought about those things that I believed were trivial... But these collisions turned out to be necessary, desirable even. The final planning of roads and public transportation system adopted quite some advices from these IT guys.

Apart from enhancing diversity, the overlaps in membership also disrupt the institutionalization process in these dense clusters. Intensive connectedness could gradually lead members' attention to interpersonal relationships and institutional norms, yet away from the work at hand. Thus, over emphasis on cohesiveness in a dense cluster decreases the possibility and willingness to create or adopt new ideas/perspectives in a group. With the disruptions caused by overlapping membership, however, the chances for attention to switch back to collective performance increase. As Choi and Thompson pointed out in their 2005 paper, regular variations in membership could aid the generation and adoption of new ideas as far as these ideas were perceived as useful. This was because with weakened focus on interpersonal relationships or status system, the group's performance became the source of meanings to members' actions.

Another advantage of having such overlaps is shown on the system level. Gary, the project manager of Smartie proclaimed that the overlaps among these working groups is a mechanism that endowed him good access to any good ideas that emerged in the system. He would not worry about working groups screening these ideas out prematurely, because “If I do not have information from one way, there is chance to get it from another”. Such arrangement thus aided the organizational balance between search and stability, and contributed to the collective creativity of the system (Rivkin and Siggelkow, 2003).

Overlapping among modules is not the only way of creating spatial disruptions. Other tools, such as regularly organized cross-sectional workshops, etc. could also carry out similar functions. To sum up, governance arrangements that create spatial disruptions could lead to a dynamic process that facilitate the integration of diverse ideas and perspectives without overly compromising the existing structure and coordination. Therefore, it serves as a great tool to negotiate the tradeoff between “idea problem” and “action problem”. The beauty about these spatial disruption tools, such as the overlapped modules, is that they constantly generate dynamism to change, to recombine and to create without requiring intentional interventions from any individuals. Such finding extends the research of Okhuysen and Eisenhardt (2002) on how formal interventions enable knowledge integration and flexibility in groups.

It is worth noticing that the spatial disruption tools described above do not equal social network ties that play a passive role in transmitting information across boundaries, which may induce innovations. Rather, these tools can play a much more active role in mobilizing and recombining knowledge and resources from different locations, and have potentials to facilitate much stronger collective creativity. This is because such spatial disruptions affect the interactive

patterns among organizational members directly and force in-depth sharing and communications among members.

It also worth noticing that in order for spatial disruption to be beneficial, it has to be generated in an orderly manner. The case of Flower River can serve as a counter example. In this case, no governance arrangements were developed to create a dynamic process of spatial disruption. In order to counter the “idea problem” and help modules to obtain necessary knowledge to perform cross-sectional tasks, project managers had to adjust module membership and workflows from time to time “by hand”. Unfortunately, such interferences undermined the autonomy of the modules and disrespected their working space. Resultantly, people felt confused and collective creativity was deteriorated instead of enhanced.

Proposition 1: Ordered spatial disruption has a positive effect on the emergence of collective creativity.

Ordered Temporal Disruption

Time pacing is an important construct to manage complex tasks, especially tasks with strong interdependencies. Under such circumstances, either it is too costly to evaluate the progress based on the task itself due to its complexity (Okhuysen, 2001), or it is impossible to coordinate interdependent sub-tasks without a common metric. As time is a universal dimension to all activities, it can serve as an effective common metric to evaluate progress and guide the coordinative work.

The relationship between time pacing and collective creativity, however, is not as straightforward. Conventionally, temporal constraints, such as deadlines or milestones, were regarded as negative influencers to creativity as it could bring pressures to people thus squeeze out the space for creative endeavors (Amabile, 1988). However, some researchers had raised different thoughts. Gersick's research (1988, 1989) on punctuated equilibrium, for example, showed that special temporal points, such as the midpoint of a task, could remind organizational members to reflect on their previous work and induce abrupt adjustments or changes to their activities. These special temporal points "punctuate" the "equilibrium" status of work, facilitate searches for new ways of doing things until a new state of equilibrium settles in. Clearly, with this model, time pacing serves as stimulus of creativity, rather than constraint.

Disparate from the punctuated equilibrium model, Brown and Eisenhardt (1997) focused on continuous, instead of punctuated, change. Nevertheless, their multiple-case study also indicated that firms, which exhibited higher creativity, applied time-paced transition processes to probe into the future. They termed these loose organizing structures as "semisttructures" (Brown and Eisenhardt, 1997; Okhuysen and Eisenhardt, 2002). Time pacing serves as a semistucture for its capability of providing a guiding framework to work processes without interfering the work itself. It is also a mark that gives organization members the chance to stop and think, to sort out priorities, and to consider alternative directions for the coming period (Okhuysen and Waller, 2002).

The work of Staudenmayer, Tyre, and Perlow (2002) raised a particularly interesting construct—temporal shifts, i.e., changes in a collective's experience of time, for example, "to perceive different levels of production pressure or to feel greater (or less) discretion over their time" (p. 588). In other words, what facilitates collective change and innovation is not

particularly time itself, but changes in time. Their field studies on three technology intensive organizations showed that temporal shifts enabled creative behaviors with the following four mechanisms. First, temporal shifts triggered organizational members to reevaluate current situation and allowed them a chance to consider the possibilities of doing new things or doing old things in different ways. Second, a change in normal rhythms might enable organizational members to release immediate time pressure and assume an agenda to innovate. Third, temporal shifts gave organizational members a rare opportunity to look up from what they were doing respectively and concert efforts to engage in a collective creation process. Fourth, temporal shifts are symbols to mark the importance of innovation and change.

Our empirical studies of the four collaborative organizations on smart city projects revealed the importance of another time-related construct—ordered temporal disruptions—to collective creativity in groups and organizations. Similar to temporal shifts, ordered temporal disruption also emphasizes the effects of changes in time pacing on the collective creativity of an organization. However, unlike temporal shifts that relied on interventions of individuals, ordered temporal disruption is more regular and depends on more structural arrangements.

The most observed way of creating ordered temporal disruptions is by setting two clocks for the organization at the same time. One clock is for guiding work processes on the system level and the other for sub-system level. In fact, there can be more clocks considering different sub-system units do not have to share the same clock and an organization can have more than two layers. The key is: time pacing for different levels of the organization should be intentionally kept inconsistent so that organizational members would experience regular disruptions in their workflow and variations in time pressures.

In the case of V-City, project teams, i.e., the sub-system working units of the collaborative organization have full discretion of their operation, including time management. However, from what we observed, most of the project teams were managed by time pacing. One of the project team leaders told us (translated from Chinese):

We adjusted during the process. At the beginning, I just asked everyone to do their best. Some of the team members are not from our company, you know, especially the experts invited. I felt uneasy to set hard restrictions on them. But soon I found that this wouldn't work. We are working on a very complicated task. If one finished one's work, and another did not. The whole task would not be able to advance. So we decided it would be for everyone's best to manage by hard time constraints.

The project board, which is the system-level management, set a number of periodical mechanisms and goals that all project teams have to respect, such as, biweekly meetings of all sub-units to present the progresses and discuss problems encountered, monthly workshops on special topics to facilitate integration of specialized knowledge of members. The project manager of V-City especially emphasized the importance of “milestones”, i.e., goals set to be met at certain time points. He proclaimed that those milestones were what pushed the project ahead albeit numerous disputes and conflicts.

The simultaneous existence of two time schemes and the according inconsistencies between them regularly disrupted the workflow of organizational members, and kept the

organizational members alert of the evolution of the project. As the leader of smart traffic team of V-City recalled (translated from Chinese):

The meetings (biweekly meeting of project board) put quite some pressure on me. The fact that it is a face-to-face meeting made me felt it was some kind of competition. I do not want to lose face in front of my colleagues. To hear what the others were doing and how they advanced made me aware of where I was. We (the project team) adjust our work following the feedbacks.

Why would ordered temporal disruptions contribute to collective creativity in an organization? Foremost, it is because those disruptions raised attention of organizational members. In Gersick's punctuated equilibrium model, midpoint was regarded as especially crucial for group's creative behaviors and major process transitions (Gersick, 1988, 1989). Is midpoint a magic point? Yes and no. The reason why midpoint appears to have stronger significance for collective creative process than other time point is that human cognition pays more attention to such special points. With a double-clock system, all temporal disruptions could stimulate organizational members to re-evaluate their progress, to re-consider their choices, and to re-direct their efforts in order to better fit system requirements. In a way, many "midpoints" are created thus provide more occasions for collective creative endeavors to occur.

Another possible reason why ordered temporal disruption contributes to collective creativity might be that the system-level time pacing offers occasions for integrative processes such as "creative synthesis" (Harvey, 2014) to happen. As collective creativity is fruit of

recombination of different ideas and perspective, such occasions can significantly enhance the possibilities of finding new and useful solutions to problems. As the one of the participants in the Smartie project described:

We were stuck with that problem (energy saving for an office building) until S (a partnering company) demonstrated us their new findings (from data they collected) that in fact, the peak of the building's energy consumption happened during lunch break. It came to me that, as it was summer, it must be that people left the office with air conditioning on and the frequent opening of doors brought in hot air... and then we thought about this (creative solution)...

To sum up, as ordered temporal disruptions guide people's attention from the old ways of working to new possibilities, and provide opportunities for integrative process to happen among diverse perspectives, it is a significant construct for the emergence of collective creativity.

Proposition 2: Ordered temporal disruption has a positive effect on the emergence of collective creativity.

Ordered Affective Disruption

Mannix and Neale (2005) pointed out that in order for an organization to transform diversity into collective creativity, attraction among organizational members is an important

mediator, as the emergence of collective creativity requires in-depth communication and knowledge integration. Such argument fits with conventional wisdom. Positive, collaborative affective tone in a group or organization is usually regarded as beneficial for the emergence of collective creativity. It encourages people to associate with each other and have better positions to mobilize diverse resources to achieve higher capability in creative problem solving (Isen et al., 1987). A number of our interviewees from Smartie and V-City expressed their appreciation for the positive and collaborative affective tone in their respective collaborative organizations, and how such affective tone facilitated collaborative efforts, including creative efforts. One participant of the V-City project remembered:

At some point of time, I would say, at the beginning there would be some fears of the others. At some point in time, everybody will start to understand what the others are doing. Then, there is a clearer picture and finally if in addition to that there is some respect, some mutual respect, for people, then you start to understand it is not your enemies who are around the table. You have people who can bring some added value. You can play together. I would say that I am afraid of whatever I do not know. When I start knowing the others, I began to collaborate with them better.

However, George and King (2007) raised concerns over the impact of positive and collaborative affective tone on collective creativity, especially when the tasks are complex and ambiguous. They argued that when the affective tone is prevailingly positive and collaborative, it might actually make it more difficult for members to voice their true thinking, especially when

their opinions differ from the ones held by majority. This might be one of the reasons why some brainstorming meetings do not function as well as expected. Moreover, overly positive and collaborative affective tone might lead the organizational members to construct a single shared reality, thus decrease the opportunities of finding alternative solutions to problems encountered. Thus, George and King (2007) argued that some degree of heterogeneity in affective tone promotes, instead of suppresses collective creativity in a group or organization.

This point of view is also consistent with our empirical data. The organizations that exhibited stronger collective creativity did appear to have richer array of affective tones. When asked to describe members' collective efforts in problem solving, one of the representatives in the Smartie case stated:

I would say that those collaborative efforts may sometimes evolve into minimum efforts. That is to say, doing the minimum and getting the maximum, but they may also evolve into some competitions, where everybody will learn from others, at some point of time everybody also wants to try to demonstrate that we really have given some added value. I think we reach that in some sense. I mean everybody has reached a position, I mean, look at (Company A) and (Company B) for example, everybody really wants to demonstrate that flexibility management is able to do that a bit better than the other. (Company C), which is kind of an IT company with some energy background, is trying to demonstrate that they can bring much more than (Company D). That is part of it, and also if you look at the large group like (Company E), they are kind of the historical operator of national grid but they try to demonstrate that for this project, they can be innovative also.

Another representative in the Smartie also pointed out that for the representatives, they also faced competitive pressure from within their respective firms.

Yeah. On the company level, of course I hope all our projects went well, but as a project manager, basically at some point of time, I was mainly concerned by my own project. I want this project to work. That is kind of the competition within the company. It pushed me to work with other representatives on Smartie.

In a way, negative affections triggered by competitions or other sources of pressure, when contained under a threshold, play a motivational role for organizational members, and push people to make more efforts in order to achieve better results (Woodman, Sayer and Griffin, 1993).

Apparently, neither positive affection nor negative affection has a monotonic relationship with collective creativity. They are both resources for groups and organizations, that, when applied well, can enhance collective performance. While a delicate static balance is quite impossible to achieve, our empirical study revealed that ordered affective disruption could be an effective tool to manage affective tone in order to achieve higher level of collective creativity.

In both of the two cases with strong collective creativity, we observed that the prevailing affective tone was positive. Such positive affection was built on the common wish to finish the

collective tasks well, mutual understandings among partners, and optimistic expectations of the industry's future. However, the project managers exhibited strong interpersonal skills. They intentionally embedded elements that could provoke competition, or certain pressures so that people could stay motivated. In V-City, the project managers established a digital board to publicly present the progresses of all project teams, and the information was updated every Monday. The project managers of Smartie sometimes intentionally named more than one working groups for the solving of a difficult problem. As one project manager of V-City said (translated from Chinese):

The problem and blessing of our kind of organization is that our members are not just our “employees”. They have their own companies as well and are our partners. People joined us because they acknowledge that smart city is going to be a large industry for the future. It is good for our society and can solve real problems China faces. So, we have this tight and loose relationship. On one hand, we cannot order our partners what to do. On the other hand, people are self-motivated and they would like to work better. As far as we set up the goals, time pacing and provide channels for communicating and sharing, they can come up with creative solutions.

Proposition 3: Ordered affective disruption has a positive effect on the emergence of collective creativity.

Table 6: Overview of the Organizational Dispositions of All Cases			
Name	Ordered Spatial Disruption	Ordered Temporal Disruption	Ordered Affective Disruption
V-City	Yes <i>Overlapping modules; Intentional shifts in membership.</i>	Yes <i>Periodical meetings on system level; Application of milestongs and deadlines.</i>	Yes <i>General positive and collaborative affective tone with mild negative affections associated with competition and time pressure.</i>
Flower River	No <i>Blurry boundaries among modules; Ad-hoc intervention on modules' membership and responsibilities.</i>	No <i>Irregular meetings on both sub-system and system level; Task-oriented evaluation system, with soft time constraints on both sub-system and system levels.</i>	Yes <i>Positive and collaborative affective tone; Avoidance of negative affections as much as possible.</i>
Smartie	Yes <i>Overlapping modules; Clear boundaries for modules with encouragement for cross-module cooperation.</i>	Yes <i>Periodical meetings on both system and sub-system levels; Wide applications for hard time constraints.</i>	Yes <i>General positive and collaborative affective tone with mild negative affections associated with competition and time pressure.</i>
River Village	No <i>Clear-cut boundaries for modules; No overlapping amonogs modules.</i>	No <i>Temporal pacing on sub-system level; Task-oriented evaluation system, with soft time constraints on system level.</i>	No <i>As the collaborations among partners were weak, it was difficult to spot affective tones in this project.</i>

Discussion

Collective creativity is a complex phenomenon. Previous research on collective creativity is not only scarce, but also led to inconsistent and sometimes even contradictory results (Bissola and Imperatori, 2011; George, 2007). Such inconsistency might come from the fact that collective creativity is indeed pulled by opposing forces. In the previous text, we already demonstrated how delicately spatial density, time pacing and affective tones affect collective creative processes. Under this circumstance, static examination of collective creativity would not be able to yield consistent results.

Our findings on “ordered disruptions” and the mechanisms that facilitate and maintain the emergence of collective creativity proved that a more dynamic approach of studying collective creative process could lead to interesting and promising results. Researchers should pay more attention to “Organizational vacillation” (Boumgarden et al., 2012), and the research question should not be about how to achieve a balance between collective creativity and coordination, but rather how to foster a balancing process.

The process of transforming diverse knowledge and skills into collective creation depends on conscious engagement of organizational members in mobilizing and integrating resources available (Hargadon and Bechky, 2006). Such need for mindfulness is exactly why ordered disruption can serve as powerful tools in facilitating and maintaining the collective creation process. This paper only mentioned a few organizational arrangements that can create those kinds of ordered disturbance. Creativity is needed to find more such arrangements.

CHAPTER 5:

Conclusion

It is not an exaggeration to say that data, and digital technologies in general, are transforming the nature of organizing. Management researchers, economists and sociologists should pay enough attention to such transformations, and be aware that existing organizational, economic and social theories are facing tremendous challenges in this era and need to be scrutinized with care before applying. This thesis answers to those challenges by re-examining one of the fundamental blocks of organization science: governance design.

The major contribution of this thesis can be synthesized into three aspects.

This thesis added “time” into the consideration for governance choices. That is to say, instead of considering what would be the best organizational configurations to realize the utilities with a pre-defined set of resources, or “static efficiency”, it pays more attention to “adaptive efficiency”, i.e. what would best enable the fitness of an organization in creating future resource set and ways of unearthing value from them. This change of perspective is essential for organizational science. With a static perspective, market would be the predominant institution for economic activities, because with a static perspective, resource allocation, instead of resource creation, is the central task of an economy. From this standing point, organizations are mere institutions to make up “market failures”, i.e. the peculiar occasions when market could not function as well, for the sake of uncertainty. As neo-classical economics, including transaction cost economics, is a school built on static equilibrium models, it is only natural that organizations play marginal role in its theoretical constructs. However, the relentless speed of change and the indispensable demand for creativity in the digital age call for more awareness and attention to the “value creation” role of organizations. Albeit resource allocation is important, organizations are the key actors to pool resources together and combine them in creative ways so that value can be generated. By altering the local institutional environment, organizations

incentivize economic agents to collaborate in ways impossible in pure market. In other words, the role of organization is not just about complementing market in realizing static efficiency, but more about enabling collective value creation processes that enhances the adaptive efficiency of our economy and society.

The much more expanded understanding about the roles of organizations, corresponds with the much larger space for organizational governance design. This is the second major contribution of this thesis. The rise of digital technologies significantly lowers the transaction costs for communication, and visibly encourages the demand for more autonomy from creative workers. As a result, the call for “anti-bureaucratic” organizational arrangements, such as “flat” organizations and horizontal structure, is catching more and more attention. While I agree with the general trend, it would be oversimplifying if we limit our imagination about governance choices to be binary between hierarchical and flat. The theoretical and empirical research of this thesis showed that governance can indeed take much more diverse forms and hierarchical structure and more distributed structure can complement, instead of contradict, each other. In Essay 2, for example, the empirical research discovered that it requires organizations to be both layered and distributed to outperform in integrative coordination. The thesis especially raises attention for participative community as a new norm of governance in digital age. Further research are greatly needed to test the theoretical model proposed here and explore participative community as a new norm of governance in more detail.

Last but not the least, the thesis contributes to and calls for more research on organizational processes, or, to be more specific, on the interplay between organizational forms and organizational processes. The reliance on quantitative research methods for management research has led more and more researchers to outcome research, rather than process research.

Compared with causal relations, causal mechanisms are often under-studied. While the patterns of interactions among agents become more and more complicated, and situational factors become more and more diverse and changeable in digital age, the accuracy and applicability of outcome research results are more and more limited. Process research that tackles directly the causal mechanisms is called upon. Take collective creativity for example, it is a phenomenon that exists only in the interactive process of idea communication and collision. Our findings on “ordered disruptions” and the mechanisms that facilitate and maintain the emergence of collective creativity proved that a more dynamic approach of studying collective creative process could lead to interesting and promising results. The research question should not be about how to achieve a balance between collective creativity and coordination, but rather how to foster a balancing process.

The ambition of this thesis is not about exhausting possible governance choices in digital age. Quite contrarily, the purpose of this thesis is to demonstrate and prove to other researchers that, organizational governance can and should take more diverse forms, especially in digital age. This thesis wants to initiate discussions about the transformed nature of organizing in this digitalized world and encourages more researchers to join force for this endeavor. That being said, I have to admit that the research I did is far from being mature, and have tremendous limits. More research is needed to comprehend better the specificities of the digital age and discover creative ways of organizing.

Appendix 1: A Brief of “Smartie” Case

Smartie was a pilot project in Western Europe for energy optimization at the neighborhood level. It contained a business district and a residential district. Smartie aimed to take advantage of the Internet of Things and exploit data in order to select the most relevant grid projects to meet the needs of the neighborhood areas and their inhabitants. Ultimately, the project targeted better use of energy, better integration of local renewable energy production, and better optimization of energy distribution and consumption in the overall grid.

Smartie was at the crossing of three pillars: energy, digital technology and city. As a result, the initiator of this project, a real-estate company, united ten industrial partners to form a consortium, which is the organizational body that plans, manages, executes and maintains the project. All partners were from extremely diverse industries and most of them were leaders in their respective domains. The consortium took a multi-layered and multi-centric structure. The real estate developer behaved as the central coordinator of the project. All decisions were made collectively during monthly meetings and required the presence of all ten industrial partners. Ten working groups were also established. Each of them was an operational unit. They enjoyed significant liberty to rule over their respective domain. Eight of the working groups were named after their operational function, e.g. energy storage, public lighting, energy production, and so on. The partners may take the lead of one working group but all of them are expected to contribute to the work of every working group. The leadership positions were negotiated prior to the formation of the groups. Except for being the leader of one working group, each partner could participate as many working groups as they wished. Thus, there were some overlaps among the members of working groups.

Appendix 2: A Brief of “V-City” Case

V-City is a new district of a large city in the southeastern part of China. It aimed to use smart technologies to improve social governance and make social services more easily accessible to its residents. The initiator of this project was a designated office of the local government. The emphasis of this project was on city governance. An integrated digital center was built to manage various public services in an integrated manner.

This office of the local government behaved as the central coordinator of the project. However, they did not behave as headquarter of the overall collaboration. Instead, they united external experts and related enterprises to form a project board, which was in charge of the planning, management and quality control of the project. Project teams were formed for operational issues on various aspects of the integrated project.

The project was carried out in a piecemeal manner. From the start, the project board was clear that they could not make all the plans *ex ante*. As a result, the project board focused on regulating the aspirations and standards of the project, and make sure that there was an ongoing collective learning process. As the project was carried out in a piecemeal manner, new partners join the project gradually. However, thanks to the digital center and clear technical standards, the overall project stayed compatible and integrated.

Appendix 3: A Brief of “River Village” Case

River Village was a project in a city of 80,000 inhabitants in Western Europe. The city was developed with emphases on sustainability and social well-being. It applied smart technologies to improve security of the city, facilitate economic growth, and reduce environmental impacts.

In this project, a team in local municipality was directly in charge of the management and operation of the project. There were six companies that behaved as the industrial partners for the project. Their involvement into the project varied. One of the IT firms worked especially closely with the local government team and the rest of the partners worked mostly through outsourcing contracts directly signed with the local government.

For this project, the team in local government administration really acted as headquarter of the collaboration. Although they consulted the opinions from some of the partnering companies and experts, they made exact plans about what to do in the project. Most of the partnering firms took orders from local government and signed well-defined *ex ante* contracts with the local government about the goods and services they would deliver. Interactions among the partnering firms were limited. Overall, the project was developed in an orderly manner yet little collective creation process was spotted.

Appendix 4: A Brief of “Flower River” Case

Flower River is a green field project in an inner city of China. It aimed to build a national model in China for green and low-carbon development. The functionality of this new district was positioned as “a new generation of city that provides international services and technological innovations”.

Important digital infrastructure was built into the new district at the planning phase of the project, such as optical cables, base transceiver stations and wifi poles. However, the emphasis was mostly on city planning and architecture. The “smart” part of the development did not enjoy clear visions. A company under the holding of the local government carried out the project management of this project. They kept an extremely open attitude about the development of smart applications in the district, and insisted on a rather “flat” form of governance. Smart applications, such as the smart card system, were mostly initiated by one partner and then joined by a variety of partners along the way.

Such “open” and “flat” organization made Flower River a vivid and dynamic project, yet the drawbacks of such an “open” organization were also salient. The sub-projects often spanned into extreme complexity and the project duration could be long. More importantly, different sub-systems oftentimes have compatibility issues, thus created the problems of “information island”, i.e. data could not be analyzed on a united platform, as well as the problem of fragmentation and repetition. The continuous changes in project orientation induced major waste of energy and time, as much work as to be redone due to such changes. What is more, newly joined partners quite often ended up in acute conflicts with the old ones.

Appendix 5: A Brief of “Business-U” Case

Business-U was a renovation project in Eastern Europe. It intended to build up a modern city district on the former territory of a factory. The project aimed to create the largest knowledge-based business center in the country. It attracted a number of innovative companies and a business school set its campus in Business-U as well.

Two companies developed the project. One was in charge of one third of the project and the other of the remaining two thirds. Although the project was intended to provide unique and inspiring environment to promote creativity, the project mostly reduced to a commercial real estate development. The process of project management was also a typical one for commercial real estate development. Sub-contracting was the main form of inter-firm collaboration. The two leading companies did not have strong interactions with each other either. Although the project was a commercial success, it did not exhibit strong “smartness”.

Appendix 6: A Brief of “Lakeside” Case

Lakeside was a green field project in a major city situated in the center of China. It was a project with international collaboration and aimed to build a city district that was environmental-friendly and energy-efficient. Lakeside was a politically high-profiled project, as it was a collaborative project between China and Country M.

There were three major collaborative parties for the project. One was the city planning body of the focal Chinese city; one was the diplomatic agency of Country M in China, and the other was a team made up of a number of private firms from Country M. This three-way structure ended up causing serious confusion in divisions of responsibilities. As a result, the project stayed in the planning face for more than three years. As the three parties did not form an official organizational body to manage the project, the interactions among them were kept rather irregular.

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Titre : Trois essais sur la conception de la gouvernance   l' re num rique

Mots cl s : gouvernance, efficience statique, efficience de coordination, efficience cr ative, cr ativit  collective

R sum  : Le principal objectif de cette th se est d'expliquer en quoi l'efficience statique (*static efficiency*), l'efficience de coordination (*coordinative efficiency*) et l'efficience cr ative (*creative efficiency*) jouent un r le d terminant dans la conception de la gouvernance   l' re num rique. Il s'agit  galement d' tudier des m canismes originaux de gouvernance, au-del  de la traditionnelle dimension march -hi rarchie, pouvant faciliter les processus de coordination int grative (*integrative coordination*) ainsi que de cr ation collective dans les organisations.

La th se comprend trois essais. Le premier est une contribution de nature th orique montrant que l' conomie des co ts de transaction (Williamson 1979, 1991, 1996, 2002) ne permet pas de rendre compte de fa on satisfaisante de la conception de la gouvernance   l' re num rique. Le mod le conceptuel normatif propos  contribue   repenser celle-ci dans une perspective pluraliste int grant complexit  et vari t . Les choix de gouvernance ne sont ainsi plus limit s   la seule dimension march -hi rarchie comme le laisse penser l' conomie des co ts de transaction. Une perspective int grant la construction sociale des modes d'organisation (Giddens, 1985; Greenwood et al. 2011) permet de d finir une vari t  de formes de gouvernance. Il est possible de repr senter, dans un espace   trois dimensions (efficience statique, efficience de coordination et efficience cr ative), les diff rentes configurations de gouvernance sous la forme d'un triangle. Cette repr sentation peut  tre appliqu e afin de rendre compte des choix de gouvernance possibles   diff rents niveaux organisationnels.

Les deux essais suivants sont   dominante empirique. Ils visent   prolonger le premier en  tudiant le lien entre des configurations innovantes de gouvernance et la performance des organisations en mati re d'efficacit  de coordination et d'efficacit  cr ative.

Le deuxi me essai se concentre sur la coordination d'int gration dans les organisations. Des structures organisationnelles distribu es   plusieurs couches ou *layered distributed organizational structures* (Simon, 1962), des plans d finis ex ante de fa on impr cise ou *broad-brushed ex ante plans* (Edmondson, Bohmer et Pisano, 2001), ainsi que des *semi-structures* (Brown et Eisenhardt, 1997) s'av rent utiles au processus de coordination lorsque les interd pendances sont complexes et incertaines.

Le troisi me essai porte sur la performance des organisations en mati re de cr ativit  collective. Il s'int resse notamment aux dispositifs organisationnels facilitant l' mergence d'une telle cr ativit  tout en pr servant stabilit  et efficacit . Plusieurs formes de perturbation qualifi es d'ordonn es (*ordered disruption*), tant au niveau spatial (*ordered spatial disruption*) que temporel (*ordered temporal disruption*) et affectif (*ordered affective disruption*), contribuent   l' mergence de la cr ativit  collective.

Le mat riel empirique utilis  dans les deuxi me et troisi me essais provient d'une  tude des modes de gouvernance de diff rents projets de villes intelligentes (*smart-cities*) n cessitant une collaboration entre plusieurs organisations.

Title : Three Essays on Governance Design in Digital Age

Keywords: governance design, static efficiency, coordinative efficiency, creative efficiency, collective creativity

Abstract: The main objective of this dissertation is to explain why coordinative efficiency, creative efficiency, together with static efficiency are all critical goals of governance design in digital age, and to explore innovative governance arrangements, beyond the one-dimensional line defined by “market” and “hierarchy”, that can facilitate the processes of integrative coordination, and collective creation in organizations.

The dissertation is composed of three essays. Essay 1 is a theory paper that provides the overall theoretical arguments about why transaction cost economics (Williamson 1979, 1991, 1996, 2002) is no longer a satisfactory theoretical framework for governance design in the digital age, and offers a normative model which suggest possibilities of much more nuanced, complicated and pluralistic governance choices than suggested by transaction cost economics. It is argued that potential governance choices are not solely situated on a one-dimensional line between hierarchy and market, as transaction cost economics asserts. The rich connotations of socially constructed agency (Giddens, 1985; Greenwood et al. 2011) provide diverse possibilities of governance arrangements, which spread across a triangular plane in a three-dimensional space defined by static efficiency, coordinative efficiency and creative efficiency (see Figure 1). This paper provides both graphic and mathematical presentations of this three-dimensional model for governance design, which can be applied to different levels of organizing.

Essay 2 and 3 are two empirical papers that endeavor to extend Essay 1 by finding out the exact relationship between certain innovative governance arrangements with organizations’ performance in coordinative and creative efficiencies. Essay 2 focuses on the realization of integrative coordination in organizations. It found out that layered distributed organizational structure (Simon, 1962), broad-brushed ex ante plan (Edmondson, Bohmer and Pisano, 2001), and semi-structures (Brown and Eisenhardt, 1997) are beneficial in facilitating an ongoing coordination process when interdependencies are complex and uncertain. Essay 3 focuses on organizations’ performance in collective creativity (Shalley et al., 2004; George, 2007), especially on what governance arrangements can best allow collective creativity to emerge without overly sacrificing organizational stability and efficiency. It is discovered that “ordered disruption”, including ordered spatial disruption, ordered temporal disruption and ordered affective disruption, have positive effects on the emergence of collective creativity. Both Essay 2 and Essay 3 use collaborative organizations on smart city projects as the empirical setting. The findings of these two empirical papers are grounded on multiple case studies on those collaborative organizations.