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Collaborations complexes : modèle théorique et vérification empirique préliminaire en contexte de projets interdisciplinaires et interorganisationnels

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Résumé

La collaboration constitue une stratégie efficace pour aider les organisations et les individus à évoluer dans des environnements dynamiques et complexes, et génère de nombreux avantages cognitifs, affectifs et pécuniaires. De plus en plus, les équipes de travail sont impliquées dans des collaborations complexes, lesquelles requièrent de transiger à travers les frontières nationales, organisationnelles et disciplinaires. Bien que les collaborations complexes soient de plus en plus courantes en milieux organisationnels et étudiées par les scientifiques, peu d'études empiriques ont été réalisées sur le sujet et la documentation inhérente est disséminée dans divers silos parallèles de connaissances, donnant lieu à des modèles conceptuels divergents et incomplets. L'importance croissante de ces formes de collaboration crée l'impératif scientifique et pratique d'en acquérir une meilleure compréhension ainsi que d'identifier et d'évaluer les conditions et les facteurs qui favorisent leur succès et leur efficacité.

Cette thèse vise à combler les lacunes susmentionnées et permettre un avancement des connaissances sur le sujet par l'entremise de deux articles répondant à divers objectifs de recherche. Le premier article avance une définition claire des collaborations complexes, en vue de réduire la confusion entourant ce construit. Il présente également la première revue de documentation sur les facteurs favorisant le succès des collaborations complexes, unifiant les résultats issus de divers contextes et disciplines scientifiques. Cette démarche a permis d'identifier 14 variables clés provenant de 26 études empiriques. À partir de ces données, un modèle conceptuel fondé sur des assises théoriques solides et reconnues en

psychologie du travail et des organisations est proposé, offrant ainsi un canevas systémique et dynamique du phénomène ainsi qu'une orientation détaillée des pistes de recherches pertinentes.

Le deuxième article part des résultats obtenus dans le premier article afin d'évaluer empiriquement les relations entre certains facteurs clés ayant un impact sur des extrants importants de collaborations complexes. L'étude multiphasique est réalisée auprès de 16 équipes de projets (*N*=93) interdisciplinaires et interorganisationnelles prenant part à des sessions de travail intensives visant la production de concepts novateurs en design intégré lié au développement durable. Les analyses corrélationnelles montrent des liens positifs entre l'ouverture à la diversité, les processus collaboratifs, la viabilité, la performance d'équipe et la performance de projet, ainsi que des liens négatifs entre les conflits et ces mêmes extrants. De plus, les analyses de médiation multiple révèlent qu'une plus grande ouverture à la diversité influence positivement la viabilité, la performance d'équipe et la performance de projet en favorisant les processus collaboratifs efficaces et en réduisant les conflits. Les implications théoriques et pratiques découlant de ces résultats sont discutées.

Mots-clés : *Collaborations complexes, groupes de travail, diversité compositionnelle, ouverture à la diversité, processus collaboratifs, conflits, efficacité*

Abstract

Collaboration is an effective strategy to help organizations and individuals evolve in turbulent and complex environments, yielding numerous cognitive, affective, financial benefits. Increasingly, work teams are involved in complex collaborations, which require working across national, organizational and disciplinary boundaries. Although complex collaborations are increasingly prevalent and studied, there are few empirical studies on the subject and related literature is scattered in parallel knowledge silos, and poorly integrated conceptually. The growing ubiquity and reliance on these forms of collaboration creates a scientific and practical imperative to improve their understanding, as well as to identify and assess conditions and factors that promote their success and effectiveness.

This thesis aims to address abovementioned gaps and knowledge advances through two articles, each targeting several objectives. The first paper provides a clear definition of complex collaborations, meant to decipher some of the confusion surrounding this construct. It also presents the first review of literature on factors fostering success of complex collaborations, unifying findings across research disciplines and contexts, which allowed to uncover 14 key variables from 26 empirical studies. Based on these findings, a theoretically grounded framework capturing functional and dynamic relationships among identified factors is introduced and developed, providing comprehensive and systemic view of the phenomenon and orienting pertinent research paths.

The second article capitalizes on findings from the first paper to empirically investigate relationships between key factors affecting important outcomes of complex collaborations. The multi-wave survey is conducted with 16 interdisciplinary and inter-organizational projects teams (N=93) participating in intense work sessions aimed at producing innovative integrated design concepts. Correlational analyses show positive relationships between openness to diversity, collaborative processes, viability, team performance, and project performance, as well as negative relations between conflicts and the latter constructs. Further, multiple mediation analyses reveal that greater openness to diversity affects viability, team performance, and project performance by way of promoting efficient collaborative processes and inhibiting conflicts. Theoretical and practical implications from these findings are discussed.

Keywords : *Complex collaborations, work groups, compositional diversity, openness to diversity, collaborative processes, conflicts, effectiveness*

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À tous ceux qui m'ont soutenue durant ce long retour aux études, et qui ont contribué, de près ou de loin, à le rendre plus agréable...

The common ground is greater and more enduring than the differences that divide.

-Nelson Mandela

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Introduction

Le fait de se regrouper pour travailler ensemble vers un objectif commun constitue une pierre angulaire de l'organisation du travail depuis les premières civilisations (Mankin & Cohen, 2004). De nos jours, ce phénomène est toujours de mise afin de permettre aux individus et aux collectivités d'arriver à leurs fins, de combler des besoins et de résoudre des problématiques multiples, par le biais de la collaboration.

En milieux organisationnels, une dynamique de collaboration efficace présente de nombreux avantages, dont notamment de nouveaux apprentissages, l'échange de connaissances, l'émergence d'innovations et de nouvelles idées, le partage de tâches, l'accès à des ressources diversifiées et l'atteinte optimale et accélérée des objectifs visés. Plusieurs chercheurs affirment d'ailleurs que la collaboration est particulièrement efficace et appropriée pour aider les organisations et les individus à évoluer dans des environnements turbulents et complexes (Gray & Wood, 1991; Scott & Thurston, 1999). Toutefois, à l'ère de la globalisation, un nombre important de démarches collaboratives échoue (Stiles & Williams, 2004), l'environnement dans lequel évolue les organisations contemporaines étant de plus en plus caractérisé par la complexité, le risque et l'incertitude (Pitsis, Kornberger, & Clegg, 2004). Les changements technologiques constants, l'avancement accéléré des connaissances, les exigences informelles inhérentes à l'économie mondiale, les demandes et conditions fluctuantes ainsi que la concurrence de plus en plus étendue et féroce des marchés ont altéré la nature et les formes de travail (Higgins & Maciariello, 2004 ; Kozlowski & Bell, 2003). Désormais, les connaissances et les

compétences constituent les ressources les plus précieuses pour les organisations et les industries qui tentent d'évoluer, voire de survivre, dans un monde de plus en plus complexe (Mankin & Cohen, 2004; Kozlowski & Ilgen, 2006). Par conséquent, celles-ci doivent pouvoir accéder à ces ressources peu importe où elles se trouvent. La capacité d'intégrer et de tirer profit d'une diversité de compétences et de connaissances, malgré les frontières de cultures diverses et de distance qui existent de plus en plus au sein des équipes, représenterait la clé du travail collaboratif en ce siècle (Cohen & Mankin, 2002). Ce nouvel impératif illustre concrètement le besoin croissant de recourir à de nouvelles formes de collaboration qui permettent de transiger avec des partenaires provenant de différentes nations, organisations, ou disciplines : les *collaborations complexes.*

Toutes les collaborations, complexes ou autres, reposent sur une même assise : les gens, les relations entre eux, et les processus interactionnels leur permettant de travailler ensemble (Mankin & Cohen, 2004), l'atteinte des buts visés n'étant pas seulement tributaires des caractéristiques individuelles des gens et des ressources disponibles, mais également des processus interactifs entre les gens dans l'accomplissement du travail collectif (Marks, Mathieu, & Zaccaro, 2001). Bien qu'il existe d'innombrables définitions du construit général de la collaboration, les plus répandues réfèrent globalement et fondamentalement au fait de travailler avec d'autres en vue de réaliser un objectif commun (Huxham, 1996), s'apparentant et englobant inévitablement le travail d'équipe (Marks et al. 2001).

Les organisations reconnaissent depuis longtemps la valeur des équipes de travail pour surmonter les défis importants engendrés par des environnements turbulents et

complexes, et il est donc naturel que ce soit la norme de recourir à elles dans ces situations (Salas, Stagl, & Burke, 2004). Les collaborations complexes s'appliquent aux équipes formelles traditionnelles mais également aux nouvelles formes d'équipes ou d'entités collaboratives ayant émergé en réponse aux exigences et défis organisationnels contemporains susmentionnés (Mankin & Cohen, 2004; Tannenbaun, Mathieu, Salas, & Cohen, sous presse).

Fitzgerald (2004) s'est spécifiquement penché sur les diverses variantes d'entités collaboratives pouvant s'appliquer aux collaborations complexes. Cet auteur stipule qu'une entité collaborative peut comprendre des individus, des groupes ou équipes, des associations, des organisations, des alliances ou réseaux d'organisations, par exemple. Les entités plus vastes, comme les réseaux, alliances et partenariats incluent de plus petites entités telles les organisations, équipes, groupes et individus, lesquelles peuvent également se recouper, illustrant bien la diversité des formes de collaboration possibles et la perméabilité des frontières conceptuelles et contextuelles (Fitzgerald, 2004). L'ensemble des entités susmentionnées présentent par ailleurs plusieurs caractéristiques communes, soit un certain niveau d'interaction et d'interdépendance entre au moins deux personnes ou entités collectives partageant au moins un but commun et étant imbriquées dans un contexte situationnel ou environnemental qui influence et est influencé par des intrants, processus et extrants (Campion, Medsker, & Higgs, 1993; Harrigan, 1988; Higgins & Maciariello, 2004; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Salas, Stagl, & Burke, 2004).

Que l'on réfère aux termes équipe, groupes[1] ou entités par lesquels se concrétise la collaboration, les dernières études sur ces phénomènes soulignent que plusieurs équipes opèrent maintenant dans des environnements plus fluides, dynamiques et complexes qu'auparavant (Tannenbaun et al. sous presse). Elles changent et s'adaptent plus fréquemment, travaillent plus souvent dans des contextes transfrontières, et sont davantage hétérogènes et dispersées géographiquement. Les équipes temporaires sont plus fréquentes, et les membres sont souvent appelés à travailler avec des gens qu'ils ne connaissent pas. Plusieurs définitions et caractéristiques traditionnelles d'équipes de travail ne reflètent plus la réalité actuelle (Tannenbaun et al, sous presse). Bref, la nature des équipes de travail et l'environnement dans lequel elles évoluent ont changé. Les collaborations complexes sont de plus en plus courantes (Beyerlein et al, 2004), cette tendance ne montrant aucun signe de ralentissement, de par la progression constante de la globalisation, des avancées technologiques et de l'avancement des connaissances (Fitzgerald, 2004). Bien qu'indispensables pour un nombre grandissant d'organisations, ces formes de collaboration sont, tel que l'indique leur nom, plus complexes que les formes traditionnelles de collaboration, comportent davantage de défis et de problématiques, et sont plus sujettes aux échecs. Face à ce constat, il est impératif, tant du point de vue scientifique que pratique, de

[1] Tel que mentionné dans l'article 1, les termes groupes et équipes sont utilisés de façon interchangeable dans cette thèse, comme le font d'ailleurs d'autres auteurs. Ce choix est motivé dans un premier temps par le fait que la préoccupation primaire de cet ouvrage n'est pas la terminologie en soi, mais plutôt dans quels contextes ces entités évoluent, et dans un deuxième temps, parce que des définitions reconnues, telles celles de Campion et al (1993) et de Salas et al (2004), s'appliquent aux diverses entités impliquées dans des collaborations complexes. Je suis toutefois d'accord avec Tannnenbaum et al (sous presse) à l'effet que plusieurs définitions et caractéristiques traditionnelles des équipes de travail sont dépassées, étant donné la complexité des défis et environnements contemporains. Je souléve d'ailleurs ce constat dans la présente thèse doctorale.

faire avancer les connaissances sur les collaborations complexes, et particulièrement sur les déterminants de leur succès et de leur efficacité. Bien que la recherche sur le sujet ait généré certaines avancées au cours des dernières années, elle présente toujours plusieurs lacunes importantes.

Failles actuelles dans la documentation

Définition du construit

À ma connaissance, aucun auteur n'a jusqu'à présent suggéré une définition théorique claire et concise des collaborations complexes. Ce construit a plutôt fréquemment fait l'objet de descriptions exhaustives, souvent liées aux défis rencontrés, ainsi que d'exemples diversifiés à partir desquels le lecteur tire implicitement des conclusions. Par ailleurs, la complexité inhérente à certaines formes de collaboration a également été abordée de différentes façons selon les auteurs. Par exemple, Duarte et Snyder (2006) conceptualisent cette complexité en termes de composition des équipes, en fonction de deux critères globaux: 1) les aspects transfrontières liés au temps, à la distance et aux organisations, et 2) les technologies de communication et de coordination utilisées ainsi que le statut non formel de certains membres. Jap (2001) suggère plutôt qu'une collaboration complexe se distingue notamment par un degré notable d'incertitude au niveau des ressources, des résultats, d'aspects intangibles et de nouveaux facteurs et processus inhérents au travail entre les entités collaboratrices.

Beyerlein, Johnson et Beyerlein (2004) offrent une description détaillée mais hétéroclite des collaborations complexes, référant simultanément dans un même texte à des capacités, à des processus, à des systèmes, à des situations complexes et aux défis managériaux qui leur sont associés, ainsi qu'à des types de projets et aux ressources y participant, tout en soulignant la dimension transfrontière omniprésente relative aux nations, aux organisations et aux disciplines. Mankin et Cohen (2002, 2004), lesquels semblent les pionniers dans ce domaine d'étude, conceptualisent ce construit en tant que formes de collaboration. Dans leurs descriptions, ils les contrastent aux formes les plus simples, en donnant l'exemple de deux personnes présentant les mêmes antécédents, intérêts et loyautés, interagissant en face à face pour accomplir des tâches simples et bien définies, dans l'atteinte d'un but commun. Ils situent ainsi la complexité sur un continuum sur les dimensions relatives à l'ambigüité et l'incertitude liés aux tâches, le nombre de personnes impliquées, la diversité nationale, organisationnelle et disciplinaire au sein des équipes de travail, la divergence des objectifs et agendas, et le degré de virtualité des communications.

Connaissances limitées sur les facteurs de succès

Malgré l'intérêt croissant de la communauté académique envers les collaborations complexes (Gray, 1991; Rivera, 2003) et l'importance et la prévalence de ce phénomène en émergence, peu d'études empiriques ont porté sur l'identification des facteurs favorisant l'efficacité et le succès de ces formes de collaboration. En effet, on retrouve beaucoup d'écrits sur les avantages, les défis et les obstacles leur étant associés, mais peu de pistes

quant aux déterminants de leur réussite. Par ailleurs, alors qu'il existe plusieurs récits anecdotiques et articles conceptuels sur le sujet, les études qualitatives, et surtout quantitatives, sont plus rares.

De plus, à notre connaissance, une seule recension des écrits se rapportant aux collaborations complexes a été menée à ce jour par Mattessich, Murray-Close et Monsey (2001). Ces efforts de recension sont louables, mais ils datent d'une dizaine d'années, et portent uniquement sur les collaborations interorganisationnelles impliquant des organisations à buts non lucratifs dont les extrants se rapportent à la dispension de services (soins de santé, services sociaux). Cette recension relate 20 facteurs de succès répartis dans six catégories (c.-à-d., environnement, caractéristiques des membres, processus et structure, communication, objectifs, et ressources) qui ont été élaborées à partir de consensus entre les chercheurs ayant effectué la recension (citation des auteurs : « *there is no research significance to the category grouping or to their names* », p.67), plutôt qu'en fonction de théories existantes, et surtout, qui ne sont pas ancrées dans un modèle conceptuel théorique quelconque.

Lacunes inhérentes à l'intégration documentaire et aux fondements conceptuels

En lien avec le peu d'études empiriques sur les facteurs favorisant l'efficacité et le succès des collaborations complexes, il est également important de souligner que les écrits sur le sujet dénotent un manque flagrant d'intégration. En effet, bien que différents facteurs et leurs extrants aient été étudiés dans des milieux et selon des perspectives diversifiés, la majorité de ces écrits ne fait pas mention des autres études menées en parallèle (Hardy,

Phillips & Lawrence, 2003). Il appert que les chercheurs de diverses disciplines s'intéressant au phénomène se concentrent sur différentes facettes des collaborations complexes, et sur différents déterminants et extrants, travaillant isolément dans leurs silos respectifs sans s'intéresser ou connaître les activités et découvertes propres aux autres silos (Beyerlein et al, 2004; Hardy et al, 2003). La documentation sur le sujet révèle donc plusieurs modèles conceptuels très différents (issus de fondements théoriques liés aux domaines de la gestion, de l'éducation, des technologies, des sciences sociales, de la recherche académique, par exemple), ainsi qu'un manque de « maillage » et de cohérence entre ceux-ci (Schreiner & Corsten, 2004). Une telle diversité en matière de théories et de recherches, imputable à un domaine de recherche en émergence, engendre confusion et désorientation (McCauley, 2006).

Les impératifs de développer de nouveaux modèles et de mettre en œuvre les conditions permettant de faciliter le travail collaboratif en situations complexes ont été identifiés il y a plus d'une décennie (Mohrman, 1999), mais à ce jour, aucun modèle théorique de référence ne semble reconnu et communément accepté dans la documentation. Tel que souligné par Schreiner & Corsten : "*Research on collaborative relationships is an emerging stream of inquiry borrowing from numerous disciplines with many important studies shedding light on different aspects. It is not yet a coherent body of knowledge*." (2004, p.147). En effet, bien que des initiatives louables aient été réalisées au cours de la dernière décennie en vue de conceptualiser et tester divers modèles théoriques expliquant les facteurs et dynamiques générant des impacts positifs sur les extrants de collaborations complexes (p.ex.: Dedekorkut, 2004; Jap, 2000; Osman, 2004; Sicote & al, 2002; Ylitalo &

al, 2006), ces modèles sont divergents entre études et ne reposent pas sur des fondements théoriques solides.

Objectifs et description de la présente étude

Face à ces constats, et étant donné l'intérêt croissant envers ce domaine d'étude en émergence et son importance majeure dans le monde du travail contemporain, il apparait impératif de combler les lacunes susmentionnées. C'est donc dans cette optique que la présente thèse a été élaborée. De façon plus précise, la thèse vise cinq objectifs conceptuels et empiriques, soit: 1) produire une définition claire des collaborations complexes à la lumière des principaux écrits sur le sujet, délimitant les critères inhérents à leur manifestation, 2) effectuer une revue de documentation exhaustive des études rencontrant les critères susmentionnés, afin de dégager les facteurs favorisant le succès et l'efficacité de ces collaborations, 3) élaborer un modèle conceptuel systémique permettant une meilleure compréhension des facteurs et dynamiques de niveaux individuel, groupal et organisationnel associés au succès et à l'efficacité de ces collaborations, 4) effectuer une vérification empirique de certains de ces facteurs par analyse de médiation multiple auprès d'échantillons œuvrant en collaborations complexes, 5) identifier des pistes de recherche ainsi que des pistes d'intervention pertinentes et ciblées, en fonction des principaux résultats émanant de cette recherche doctorale. Ces divers objectifs seront abordés dans les deux articles faisant l'objet de cette thèse. Les trois premiers objectifs font l'objet du premier article, alors que les deux derniers objectifs font l'objet du deuxième article.

Premier article

Le premier article présente d'abord une définition claire des collaborations complexes, ancrée dans les écrits majeurs sur le sujet. Cette définition décrit les critères précis s'appliquant à ce construit, à la fois pour permettre une plus grande cohérence et clarté, et pour favoriser une plus grande rigueur dans les recherches subséquentes. À la lumière de cette définition, les défis et obstacles associés aux trois contextes clés de diversité inhérents à ce construit (c.-à-d. international, interorganisationnel, interdisciplinaire), en termes de « chocs de culture » entre les collaborateurs, sont abordés, afin d'illustrer le besoin de mieux comprendre les conditions permettant de gérer et tirer profit de cette diversité. L'article présente ensuite la méthodologie et les résultats de la première revue de documentation effectuée à ce jour visant à identifier les facteurs favorisant le succès et l'efficacité des collaborations complexes rapportés dans les écrits menées au cours des 10 dernières années et abordant les contextes susmentionnés. Chacun des 14 facteurs identifiés est décrit en fonction des contextes d'étude où ils ont été rapportés, en soulignant les nuances et particularités rattachés à leurs manifestations dans de tels contextes.

En parallèle, un modèle théorique découlant de cette revue de documentation est présenté, afin d'illustrer plus clairement les dynamiques proposées entre les variables et les divers extrants rapportés dans les écrits sondés, offrir une perspective systémique, et ainsi palier certaines lacunes soulevées précédemment. Reprenant le schème fonctionnel classique intrants-processus-extrants (IPE) (Hackman & Morris, 1975) ayant inspiré bon nombre de conceptualisations d'efficacité groupale (Wittenbaum, Hollingshead, Paulus,

Hirokawa, Ancona, & Peterson, 2004), ce modèle théorique est fondé sur le modèle intrants-médiateurs-extrants-intrants (IMEI) de Ilgen, Hollenbeck, Johnson et Jundt (2005), étant donné sa clarté et sa robustesse. Ce modèle dynamique tient sa force de deux changements apportés au modèle traditionnel IPE, auquel on reproche depuis quelques années d'être trop statique, ainsi que de condenser et simplifier excessivement le fonctionnement des équipes (Salas, Rosen, & Goodwin, 2009). En effet, le modèle de Ilgen et al. (2005) conçoit plutôt les équipes en tant que systèmes complexes et multi-niveaux évoluant à travers le temps, les tâches et les contextes. Le premier changement consiste donc en l'échange du P (processus) pour M (médiateurs) pour indiquer que les médiateurs comprennent non seulement des processus d'équipe, mais également des états émergeants, lesquels exercent conjointement un impact sur les extrants. Globalement, les processus réfèrent aux actions interdépendantes des membres d'une équipe qui permettent de convertir les intrants (p.ex. : compétences, attitudes, traits de personnalité, structure groupale et organisationnelle, facteurs environnementaux, Hackman, 1975) en extrants proximaux et distaux par le biais d'activités cognitives, verbales et comportementales visant à organiser les tâches en vue de réaliser les objectifs collectifs (Marks et al. 2001). Les processus renvoient à la nature des interactions et comprennent des activités telles la planification, l'évaluation, la coordination, et la gestion (Marks et al. 2001; Salas et al. 2009). Les états émergents réfèrent à des attitudes, valeurs, cognitions et motivations qui apparaissent au niveau individuel, mais se développent au niveau groupal (c.-à-d. « *bottom up* ») au cours de l'évolution de l'équipe, et exercent un impact sur les extrants individuels et groupaux (Kozlowski & Klein, 2000; Marks et al. 2001; Ilgen et al. 2005). Les états

émergeants peuvent agir à la fois comme intrants et comme extrants proximaux car ils sont de nature dynamique et ils varient en fonction du contexte, des intrants, des processus et des extrants groupaux (Marks et al. 2001). Pour ce qui est du deuxième changement, l'inclusion d'intrants supplémentaires à la suite des extrants vise à illustrer la perspective dynamique de l'évolution des équipes et la nature cyclique de la performance des équipes; de fait, les extrants d'un épisode de performance peuvent se traduire en intrants influençant l'épisode de performance subséquent, selon le temps de mesure. Ilgen et al. (2005) soulignent d'ailleurs que la plupart des études récentes ont évolué du modèle de progression linéaire, et que de effets d'interactions ont été rapportés entre divers intrants et processus (I x P), entre divers processus (P x P), et entre intrants ou processus et états émergeants (I/P x EM).

Tel que suggéré précédemment, les extrants correspondent aux résultats ou conséquences découlant des intrants et des modérateurs, et peuvent être à la fois proximaux et distaux. Plus précisément, les extrants présentent des critères permettant d'évaluer l'efficacité du travail collectif (Kozlowski & Bell, 2003). En général, l'efficacité est définie en fonction de trois facettes, soit la performance évaluée par les personnes pertinentes ne faisant pas partie de l'équipe, la réalisation des besoins des membres de l'équipe, et la viabilité ou l'intention des membres à demeurer dans l'équipe ou de collaborer ensemble à nouveau (Hackman, 1987; Kozlowski & Ilgen, 2006; Salas, Rosen, Burke, & Goodwin, 2009). Les perspectives contemporaines stipulent que les modérateurs (processus et états émergeants) et l'efficacité se développent à la fois dans le contexte proximal social et occupationnel (tâche) dans lequel les équipes accomplissent leur travail, mais sont

également imbriquées dans un système organisationnel ou un contexte environnemental plus grand (Arrow et al., 2000; Ilgen et al., 2005; Kozlowski & Bell, 2003; Kozlowski et al., 1999; Kozlowski, Gully, McHugh et al., 1996; Marks et al., 2001, dans Kozlowski & Ilgen, 2006), illustrant ainsi la pertinence du modèle présenté dans cette thèse doctorale.

Deuxième article

Le deuxième article vise à étudier plus finement certains facteurs identifiés dans la revue de documentation du premier article comme ayant un impact considérable sur diverses résultantes des collaborations complexes. Ces facteurs sont l'ouverture à la diversité, les processus collaboratifs liés à la communication et la coordination (facilitateurs) et les conflits groupaux (obstacles), et ils sont évalués dans un modèle de médiation multiple permettant à la fois de tester l'effet de plusieurs médiateurs simultanément et de distinguer l'effet de chacun isolément (Hayes, Preacher, & Myers, 2011).

L'ouverture à la diversité est étudiée comme variable indépendante, étant donné son rapport et son apport singuliers aux collaborations complexes. En effet, ces collaborations sont principalement caractérisées par la grande diversité existant entre collaborateurs travaillant ensemble. Or, pour pouvoir bénéficier des avantages et des gains de cet amalgame de différences, les collaborateurs doivent respecter, tolérer et surtout apprécier celles-ci. Par ailleurs, très peu d'études empiriques ont porté sur l'ouverture à la diversité, et ce construit a principalement été étudié comme variable dépendante. Les processus collaboratifs liés à la communication, la coordination et la synchronie sont étudiés comme

médiateurs, conjointement et par opposition, aux conflits d'équipe globaux (permettant ainsi l'étude d'un phénomène de médiation concurrentielle). En effet, les études antérieures révèlent que ces processus collaboratifs efficaces sont fortement associés à la performance d'équipe en général (Kozlowski & Bell, 2003; Lepine et al., 2008), et plus pertinemment à la performance d'équipes interdisciplinaires et interorganisationnelles (Casey, 2008 ; Cummings & Kiesler, 2005 ; Dedekorkut, 2004 ; Peter & Fletcher, 2004). La communication et la coordination figurent d'ailleurs parmi les facteurs les plus fréquemment cités dans la recension de documentation du premier article. Quant aux conflits, ils sont constamment identifiés comme obstacles majeurs et phénomènes fréquents en contexte de collaborations complexes, en raison de la diversité des opinions, valeurs, expertises, jargons, théories et méthodologies entre collaborateurs (p.ex. Kelly, Schaan, & Joncas, 2002; Mankin & Cohen, 2004; Bagshaw, Lepp, & Zorn, 2007; Hollaender, Loibl, & Wilts, 2008; Hobman, Bordia, & Gallois, 2004; Levine & Moreland, 2004). L'impact de la variable indépendante et des médiateurs susmentionnés sont analysés en lien avec trois extrants : la viabilité des équipes, la performance d'équipe ainsi que la performance de projet.

L'étude est menée auprès d'équipes de design participant à des séances de travail d'idéation visant à intégrer plusieurs perspectives complexes amenées par des impératifs de développement durable. De par la composition de cet échantillon, l'article se penche plus précisément sur le contexte interdisciplinaire et interorganisationnel inhérent aux collaborations complexes. En effet, les projets en design intégré font appel à des équipes interdisciplinaires et interorganisationnelles regroupant différents spécialistes et parties

prenantes participant à des sessions de travail intensives visant le développement de concepts novateurs pour palier à des problèmes spécifiques (Chiocchio, Forgues, Paradis, & Iordanova, sous presse; Reed & Gordon, 2000). Par ailleurs, les données sont analysées au niveau groupal, plutôt qu'individuel, afin d'interpréter adéquatement les phénomènes groupaux étudiés. Les dernières parties de l'article présentent les résultats de cette analyse et les constats théoriques et pratiques qui en découlent.

Au terme de ces deux articles, une conclusion présente la synthèse des principaux constats et résultats émergeant de cette recherche doctorale. Les apports saillants à l'avancement des connaissances et les forces majeures de la recherche sont ensuite décrits. Un retour critique sur la méthodologie et les limites de la recherche est présenté. Enfin, des pistes de recherche futures et des recommandations pour poursuivre l'avancement de connaissances sur les collaborations complexes sont discutées.

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Complex collaborations in work groups: An integration of success factors across international, inter-organizational, and interdisciplinary contexts

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qui a pour titre *Collaborations complexes: modèle théorique et vérification empirique préliminaire en contexte de projets interdisciplinaires et interorganisationnels*

François Chiocchio		29 août 2011
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Abstract

Collaboration is effective to help organizations and individuals evolve in turbulent times and environments. Increasingly, work groups are involved in complex collaborations, which require working across international, inter-organizational and interdisciplinary contexts. Although most will agree that complex collaborations depend on numerous individual, group, and organizational factors, literature on the subject is scattered in parallel knowledge silos, and poorly integrated conceptually. This paper presents the first review of literature on factors fostering success of complex collaborations, unifying findings across research disciplines and contexts, and uncovering 14 key constructs from 26 empirical studies. Further, it provides a clear definition of complex collaborations, a theoretically grounded framework capturing functional relationships among identified factors, as well as discussion orienting future research agendas.

Key Words: *Complex collaborations, international collaboration, inter-organizational collaboration, interdisciplinary collaboration, work groups, compositional diversity*

Complex collaborations in work groups: An integration of success factors across international, inter-organizational, and interdisciplinary contexts

Collaboration is effective to help work groups[1] and organizations evolve in turbulent and complex environments (Scott & Thurston, 1999). Collaboration occurs in various contexts and comes in many forms (Fitzgerald, 2004), some of which entail greater challenges and failure rates than others, such as complex collaborations. Collaboration in work groups is simple when a small number of familiar (acquainted) people from the same organization and same functional and national backgrounds work collectively on routine tasks involving clear, predefined procedures and outcomes. Collaboration in work groups is complex when people work together across disciplinary, organizational or national boundaries on tasks that are ambiguous and entail uncertain outcomes. Although the prevalence and interests in complex collaboration are steadily on the rise, there are many shortcomings and problems with the study of this construct (Beyerlein, Johnson, & Beyerlein, 2004; Fitzgerald, 2004; Mankin & Cohen, 2004a; Rivera, 2003). First, definitions are scarce – or even absent – and lack definite conceptual boundaries. Second, there are no clear research agendas on the subject. Not surprisingly, extant literature reveals different theoretical models and a lack of cross-fertilization between them, as "multiple disciplines are focusing on various facets of complex collaboration […], each acting as a knowledge silo – unaware or unconcerned about what is happening in the other silos"

(Beyerlein et al., 2004: xvi). In addition, and most importantly, much of writings delve on obstacles, challenges and failure causes of complex collaborations, thus limiting our understanding of factors promoting efficiency and success of these collaborations (Osman, 2004). Furthermore, empirical contributions on these factors are scant as most writings consist of anecdotal reports and conceptual papers, with some qualitative studies and few quantitative data. Finally, empirical contributions tend to focus separately on either international, inter-organizational, or interdisciplinary collaboration contexts, preventing an integrative understanding and analysis of the phenomenon. In fact, to our knowledge, no systematic literature review encompassing and comparing facilitating factors across these three contexts has yet been conducted.

In light of these shortcomings, the purpose of this article is to advance knowledge as well as future research on complex collaborations through four significant contributions. First, we provide a definition of complex collaborations grounded in significant writings on the subject, specifying clear boundary conditions for increased clarity of the construct and potency of future research agendas. Second, we conduct the first literature review aimed at deciphering factors fostering the effectiveness and success of complex collaborations in literature across international, inter-organizational and interdisciplinary collaboration contexts. Notably, we focus specifically on empirical contributions – quantitative or qualitative – and exclude anecdotic accounts and opinions, as to provide strong, evidence-based knowledge and advances. Third, we present each of these variables within their context of study, while emphasizing nuances and influences particular to the latter. Fourth,

we present a theoretical model to orient future research, advance knowledge and attempt to close some gaps on the subject.

The article is structured as follows. We begin by providing a clear, literature-grounded definition and description of complex collaborations. We then describe how grouping workers from diverse disciplinary, organizational and national backgrounds contributes to foster "culture clashes", emphasizing the need to understand the conditions allowing to manage or capitalize on this diversity. Following our literature review's method, we present a table summarizing results from the review as well as a diagram of our model illustrating interactions between identified factors. We then describe each success factor in finer detail and follow with a discussion on major findings and future research paths.

The construct of complex collaboration

Collaboration has been defined both as a process and a form (Hartono, 2004). In terms of process, Gray's classical definition of collaboration refers to "a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible" (1989: 5). As a form, Roberts and Bradley define collaboration as "a temporary social arrangement in which two or more social actors work together toward a singular common end requiring the transmutation of materials, ideas, and social relations to achieve that end" (1991: 212). With a view to clarify the concept, Hartono (2004) suggests that

collaboration is a process that can take multiple forms.

In this light, complex collaborations are a form of collaboration that also obligatorily calls for collaborative processes, such as commonly reported interactive behaviors pertaining to communication, coordination, cooperation, planning and monitoring (Chiocchio, Grenier, O'Neill, Savaria, & Willms, in press; Marks, Mathieu, & Zaccaro, 2001; Rousseau, Aubé, & Savoie, 2006; Salas, Rosen, & Goodwin, 2009). However, what makes collaborations complex is that these processes are constrained by two contextual factors: inherent cultural diversity in group composition (i.e., social structural context), and high ambiguity and uncertainty pertaining to new collective endeavors and unfamiliar collaborators (i.e., task context) (Johns, 2006). Hence, literature on complex collaborations indicate that they first and foremost pertain to international, inter-organizational and/or interdisciplinary collaborative endeavors, which are typically further complicated by elements of work-related uncertainty, novelty and unfamiliarity. Complex collaborations are difficult to achieve and highly prone to failure (Stiles & Williams, 2004), as working with people with different practices, worldviews, interests, ideologies, theories, methods, languages, norms and/or values generates high potential for ambiguity, misunderstanding, confusion, divergent goals, conflict, preconceptions, stereotypes as well as disciplinary, organizational and national cultural silos (Akkerman, Admiraal, Simons, & Niessen, 2006; Bagshaw, Lepp & Zorn, 2007; Fujimoto & Hartel, 2006; Kealey, Protheroe, MacDonald, & Vulpe, 2005; Kelly, Schaan, & Joncas, 2002; Mankin & Cohen, 2004a).

The most complete and exhaustive work attempting to decipher the construct of complex collaboration have been conducted by Mankin and Cohen (2002, 2004a, 2004b) and by Beyerlein et al., (2004). In a compendium presenting theory and research of authors from a variety of disciplines, Beyerlein et al. (2004) state that collaborations become complex when the work linking people involves crossing boundaries separating functions, units, organizations, or nations. These authors add that such collaborations are requested in complex or "fuzzy" projects and problems, oftentimes characterized by conflict of cultures and practices, multiple languages, considerable amount of information, and ambiguity in roles and tasks. They claim that this form of collaboration is required in increasingly prevalent business endeavors such as large-scale global projects, joint ventures, new product development, process improvement, supply chain management, partnerships, and cross-sector alliances. Mankin and Cohen (2004a, 2004b) contrast this construct with the simplest form of collaboration involving low level of diversity; for instance, two people from the same national and professional backgrounds working together face-to-face in the same organization. These authors posit that the more diversity involved in the collaborative endeavor, the more obstacles to overcome, stressing that beyond well recognized and documented national cultural diversity, organizational and disciplinary diversity is just as problematic and challenging. Other features of complex collaborations reported by these authors involve task complexity, where inputs are not so predictable and procedures not so well defined (i.e., opposite to routine tasks that are low in uncertainty), as well as virtual interactions.

In light of the above, it appears that the common elements that comes across all descriptions of complex collaborations is primarily the presence of one, two or all three social structural work contexts (i.e., interdisciplinary, inter-organizational, international), which foster diversity in group composition and potential for cultural clashes, and secondarily task context pertaining to work involving uncertainty and ambiguity of tasks, processes and outcomes. This is in line with Johns' (2006) definition of context where situational opportunities and constraints affect the occurrence and meaning of behavior. As stressed by Gibson and Zellmer-Bruhn , "Nations, organizations and functions each have their own cultures, and representatives of these identity groups see the world in unique ways, gather and process information differently and often have contrasting expectations and priorities" (2002: 103). Hence, culture is generally defined as a system of shared actions, values and beliefs of a group, collectivity or society (Schermerhorn, Hunt, & Osborn, 2000) and is not limited to national affiliation, but rather also applies to organizational and disciplinary affiliation as well. As a source of shared understanding and sense making, culture shapes beliefs, expectations, and behaviors (Schein, 1992), therefore, impacting processes allowing collaborators to convert inputs to outcomes to achieve collective goals (Marks et al., 2001). Based on these findings, we define complex collaborations as:

> A form of collaboration characterized by moderate to high diversity[2] in national, organizational and/or disciplinary cultures of

> oftentimes unfamiliar collaborators working together on complex, ambiguous, non-routine tasks involving uncertain outcomes.

The following section briefly illustrates how diversity pertaining to these three cultures constrains work processes and influences direction and strength of various dynamics at play.

Diversity in complex collaborations: a "clash" of cultures

One obvious starting point to national, organizational and disciplinary issues is diversity. Results of studies investigating the effect of diversity have been mixed (Milliken Bartel, & Kurtzberg, 2003; Moreland, Levine, & Wingert, 1996; Thatcher, Jehn, & Zanutto, 2003; Webber & Donahue, 2001; Williams & O'Reilly, 1998). While it is associated with benefits of broader range of knowledge, skills and contacts (Bunderson and Sutcliffe, 2002; Williams and O'Reilly, 1998), stimulation of divergent thinking, creativity and innovation (Levine & Moreland, 2004), as well as new understandings (Akkerman et al, 2006), it also creates obstacles. For instance, negative affective processes and outcomes induced by perception of dissimilarity can interact with behavioral processes and outcomes, and inhibit benefits of diversity (Fujimoto, Hartel, & Hartel, 2004).

In terms of diversity in national cultures, large cultural distance between collaborative parties can generate various problems – namely those related to differences in languages, values, preferences, codes of conduct and work styles (Galarza, 1999). Hence,

the greater the cultural distance between collaborators, the greater the chances of false attributions, cultural choc and adjustment (Galarza, 1999). For instance, national cultural differences such as formality, emphasis on hierarchy, and conflict avoidance or confrontation can exacerbate language differences and greatly impact work processes as they can cause discomfort, lack of communication, and negative attributions that contribute to poor working relationships (Mohrman, 1999). In addition, employees from different national cultures tend to understand teamwork through different metaphors, leading to divergent expectations of team roles, scope, membership, and objectives (Gibson & Zellmer-Bruhn, 2002). Perceptions of successful workgroups also vary across such cultures (Gibson & Zellmer-Bruhn, 2002).

As regards diversity in organizational cultures, results from studies emphasize similar impacts on work processes and outcomes. Organizational culture commonly refers to particular ways of conducting organizational practices, which reflect the organization's shared knowledge, competences (Kostovas, 1999), beliefs and values (Schein, 1992). Innovation, attention to details, outcome orientation, risk-taking, and team focus are identified as dominant dimensions of organizational culture (Miron, Erez, & Naveh, 2003; O'Reilly, Chatman, & Caldwell, 1991; Rousseau, 1990, in Erez & Gati, 2004). Thus, inter-organizational differences in aims, perspectives, language, and procedures complicate relationships between parties, generate misunderstandings, pose communication challenges and prompt unwarranted assumptions about how things are carried out in partner organizations.

Diversity in disciplinary cultures promotes access to a broad and diverse knowledge base, but also generates considerable challenges for efficient work processes. Reich and Reich (2006) assert that due to the very nature of disciplines, each holds distinct cultural values, standards, procedures, perspectives, and communication norms. When collaborators from different disciplinary cultures work together, they may have different ideas about the purpose of their joint efforts and work within parallel and non-overlapping frames of reference when defining problems, identifying tasks, and assessing outcomes (Hollaender, Loibl, & Wilts, 2008). There is potential for theoretical incompatibilities between different disciplinary approaches and techniques, which make interactions more complex. Disagreement about the validity of disciplinary knowledge can induce conflict, and consensus is hindered by various disciplinary criteria of judgment and relevance (Hollaender et al., 2008).

As demonstrated, extant literature points to diversity as a paramount factor hindering successful outcomes of complex collaborations, while also praising its positive impact on creativity, innovation, and learning. Not surprisingly, studies linking group diversity, group processes, and various performance outcomes provide mixed results (Thatcher et al., 2003), suggesting that numerous factors are at play in the group diversity–performance relationship and that while some conditions foster successful outcomes, others exert the opposite effect. To this effect, recent reviews and meta-analyses conclude that the main effect approach generally used in such studies has contributed to these mixed results, and that greater efforts in identifying and empirically assessing mediating and moderating

factors is paramount (Horwitz, 2005; Horwitz & Horwitz, 2007; Knippenberg & Schippers, 2007; Shore, Chung-Herrera, Dean, Holcombe Ehrhart, Randel, & Singh, 2009; Stewart, 2005) as well as the need to develop multilevel frameworks comprising such factors to provide more comprehensive understanding of teamwork in diversity contexts (Horwitz, 2005; Knippenberg & Schippers, 2007).

As emphasized by Schrujer, "attributing failure [of collaborative endeavors] to cultural problems may be a more accessible justification than not being able to manage the diversity" (1999:1). In line with several authors (e.g. Jackson, Joshi, & Erhardt, 2003; Van de Ven, Rogers, Bechara, & Sun, 2008; Webber & Donahue, 2001), we posit that the issue is not whether diversity is useful and valuable, but rather what factors or conditions allow it to have positive impacts. Thus, we shift our literature review from past trends that delve on obstacles and challenges, and rather decipher factors that promote efficiency and success of complex collaborations, and identify research paths required to advance knowledge on the subject. In addition, following Gelfand, Erez & Aycan's (2007) recommendations, we avoid focusing on one cultural dimension to integrate national, organizational, and disciplinary dimensions simultaneously in our literature review.

Method

We conducted our literature search through various procedures. First, we performed computerized bibliographic searches in PsycINFO, ERIC, PsycArticle, Google Scholar and

FRANCIS using numerous keywords, including “complex collaboration”, “intercultural”, “cross-cultural”, “international”, “cross-national”, “inter-organizational”, “inter-firm”, “interdisciplinary”, “cross-disciplinary”, “transdiciplinary”, to trace published research in the period between 2000 and 2010. In addition, we also scanned bibliographic references included in pertinent articles recovered from this initial search, which allowed us to access additional material, and we conducted a search of the Internet for any additional relevant references.

Following these search activities, we proceeded to assess the relevance of studies. Studies were retained in the present literature review on factors that influence the success of collaborative endeavors, if they met the following criteria: (a) pertain to complex collaborations, in one or several of the previously described types of collaboration contexts, i.e. international, inter-organizational, interdisciplinary contexts; (b) involve at least one dimension of ambiguity/uncertainty in terms of unfamiliar collaborators/partners or task complexity; (c) address the success of the collaborative endeavor assessed in terms of performance and outcome (i.e., not merely collaborative motives or other features unrelated to some outcome); (d) include specific, empirical observations, thus not opinions, nor generalizations and anecdotal reports. Further to the criteria-based screening, we then extracted from each study factors positively impacting collaborative outcome. Overall, these criteria yielded 26 qualitative and quantitative studies from which we drew and synthesized 14 factors pertinent to complex collaborations.

Table 1 displays all retained studies according to factors, type of collaboration

context addressed by study, and research design (qualitative or quantitative). When studies specified that they applied to more than one type of contexts, they were classified in all pertinent columns (e.g., Jean, Sinkovics, & Kim, 2010 apply to both international and inter-organizational collaboration contexts). However, one must keep in mind that many international and inter-organizational studies likely also include the feature of interdisciplinarity, but authors have not focused on or mentioned it. This issue, as well as others that emerged throughout findings, are further discussed in the conclusion.

* * * * * * * * *

Insert Table 1 about here

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To easily report findings from various domains and increase coherence and clarity, we will be abiding by Cohen (1988) convention recommendations on effect sizes. Effects of r=.1, r=.3, and r=.5 will be presented as small, medium and large effect sizes respectively. In addition, all quantitative results reported are statistically significant.

Results

Figure 1 shows how we hypothesize the 14 factors identified from our literature review relate to each other. This model is based on the input-moderator-output-input

(IMOI) structure of team effectiveness[3] (see Ilgen, Hollenbeck, Jonhson, & Jundt, 2005) also accounting for temporal mediator interplay (see Marks et al., 2001). The following sections discuss each factor in detail. Factors are categorized according to the abovementioned structure, where inputs identified found from our literature review comprise individual disposition, compositional feature and executive support, and mediators include structuring and collaborative processes as well as emergent states.

* * * * * * * * *

Insert Figure 1 about here

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Factors promoting success of complex collaborations

Inputs – Individual disposition, compositional feature and executive support

Openness to diversity. Openness to diversity is "the awareness and appreciation of other ideas and values, and of racial and cultural differences." (Longerbeam, 2005:18). Hartel and Fujimoto (1999) refer to this attitude as being open to dissimilarity, in the sense of perceiving dissimilarity in a non-prejudicial way and to value it, of viewing difference as positive and being inclined to learn from dissimilar others as well as making an effort to see dissimilar others' viewpoints. Appreciating these differences and seeking out their offerings is necessary to maximize the benefits of diversity (Longerbeam, 2005). Team members displaying high openness to diversity more easily engage in open, fair and explorative

communication, thus effectively using diversity present in the team. They are also more inclined to make other dissimilar members feel that their contributions is valued, which in turn may foster greater contribution to the team (Hobman, Bordia, & Gallois, 2004). Our literature review indicates that openness to diversity is a determining factor among workgroups interacting in complex collaborative endeavors – a disposition required to fully appreciate and capitalize on the multiplicity of cultures, viewpoints, theories, and practices. Based on case studies pertaining to inter-organizational and international collaboration contexts, Mankin and Cohen (2004a, 2004b) consider valuing and embracing diversity for what it can contribute to collective and individual experience and efforts as key among individuals fulfilling liaison roles. In the context of interdisciplinary collaborations, openness to mutual learning from different disciplinary backgrounds as well as sensitivity and appreciation of diversity of perspectives between and within disciplines have been reported as crucial (Kessel, Rosenfield, & Anderson, 2003; Reich & Reich, 2006). Willingness to explore topics that may be out of one's comfort zone or not of initial interest and to continually learn about the practices, beliefs, and strengths of other disciplines enables to better access benefits associated with broader disciplinary knowledge. Hence, Peters and Fletcher (2004) report medium and high positive correlations between openness to diversity in opinions and perceived quality, productivity and profitability in inter-disciplinary collaboration context. In similar context, Kalam (2008) found high positive correlations between openness to diversity and team outcome effectiveness in achieving goals, customer service, timeliness, quality as well as productivity.

Complementary abilities/expertise. Complex collaboration calls for people with complementary individual skills and competencies working together toward a common goal (Hartono, 2004), and these evidently impact taskwork and teamwork outcomes. For instance, Dedekorkut (2004)'s study on factors influencing inter-organizational collaboration indicate that relevant professional and technical capabilities are highly correlated with measures of success (e.g., goal achievement, satisfaction, efficiency) as well as with variables pertaining to processes (e.g., open communication) and emergent states (e.g., trust, good relationship, commitment). Based on a case study with scientists involved in a newly formed geographically distributed multidisciplinary academic research project team, Hara, Salomon, Kim and Sonnenwald (2003) report that members' knowledge is valued as prerequisite for collaboration, and that writing style and approaches to science are considered very important. Hence, just as the level and relevance of individual ability and expertise impacts collaborative processes, states and outcomes, the mix of these individual features making up team composition also induces such impacts. Kessel et al. (2003) report that complementary expertise contributes to process issues such as maintaining shared mission, and to emergent states such as trust among participants from different backgrounds. They add that complementary expertise helps to resolve conflicts and tensions in innovative interdisciplinary collaborations applying to various health-related domains. Since interdisciplinarity may also induce conflicts (Jehn, Bezrukova, & Thatcher, 2008), we posit that the pertinence of interdisciplinarity must be valued by team members, hence the paramount importance of openness to diversity. Case studies from Matveev and

Milter (2004) stress the value of complementary skills in order to achieve individual growth, learning, and team contribution, and that such complementarity represents a characteristic of high-performance multicultural teams (Katzenbach & Smith, 1999; Matveev & Milter, 2004). Mankin and Cohen (2004b) suggest that complementary abilities towards a common goal represent an element that pulls together different organizations and teams in complex collaborations, an observation also supported by Hara and colleagues (2004).

Equity. Equity refers to fairness and impartiality towards all concerned, based on the principles of even-handed dealing, and implies giving as much advantage, consideration, or latitude to one party as it is given to another (Business Dictionary, 2011). Equity is emphasized as an important consideration in the development and maintenance of alliances (Ouchi, 1980). Paterson (1998) suggests that partnerships should focus on equity as to minimize or negate the differences arising from unjust or unfair treatment, and emphasize the personal and legitimatized power of each partner based on respect for the diversity among them. In addition, being treated with equal status can foster greater mutual respect (Schunn, Crowley, & Okada, 2002). Equity pertaining to status as well as to decision and planning processes among various collaborators has been raised as critical in empirical inter-organizational studies, in terms of outcome, goal attainment and efficiency. For instance, Schunn et al. (2002) assessed differences between 40 collaborators from the same institution versus 15 distant collaborators (different institutions in same city, same country or different countries) co-writing scientific papers. Their study revealed that equal-status

relationship strongly correlated with estimated probability of continuing to work together. In a previous study, Schunn, Crowley and Okada (1998) had also found that in interdisciplinary collaborations (but not intradisciplinary collaborations), equal status relationship was required for partners to want to pursue collaboration. They thus suggest that less complex collaborations – that is, local and intradisciplinary collaborations – are less affected by these social perceptions than more complex collaborations. Dedekorkut (2004) found that equity in decision making and in power distribution is strongly and positively correlated with time and resources efficiency, satisfaction with collaboration, and greater number of achieved goals as well as with open communication, trust and good relationship. Positive outcomes of equity in decision making is also stressed by Schreiner and Corsten (2004) in terms of decision consequences and acceptance of compromises among partner companies, and by Sarin and McDermott (2003) who report strong and moderate positive relations with team learning and speed to market respectively, in interdisciplinary new product development teams.

Supporting infrastructure. Supporting infrastructure is important in all forms of collaboration. However, it is fundamental in complex collaboration settings (Ylitalo, Mäki, & Ziegler, 2006). Since issues related to diversity, ambiguity and sometimes geographical distribution already constitute considerable challenges in complex collaborations, difficult access to required resources may be fatal. Sufficient human resources, appropriate technologies, tools and funding clearly facilitate success of projects (Ylitalo et al., 2006). Case studies from Kessel et al. (2003) emphasize that supportive organizational climate and

funding foster the development of successful interdisciplinary collaborations. Such observation is supported by Osman's (2004) inter-organizational study, which reveals that one of the strongest predictors of achieving schedule, budget and quality performance outcomes is the allocation of required resources such as time, technology, equipment and skill development. Investment in human resource development in terms of specialized competences and skills is also stressed as key enabler for partnership success by Casey and Richardson (2004), and for international team effectiveness by Edwards and Sridhar (2003). Moreover, Dedekorkut (2004) found that the presence of resource factors such as political support and funding in inter-oganizational collaboration context is moderately and strongly related to perceptions of greater goal achievements and successfulness as well as to commitment and participation incentive.

Supporting Management. Similarly to instrumental-like infrastructure support, support from management plays an important role in complex collaborations, whether managers directly impact collaboration or induce it indirectly by fostering an environment in which teams exercise decision-making and autonomy (i.e., self-managed teams). In all of the case studies conducted by Mankin and Cohen (2004b), high level management support and access to resources that typically comes with such support were among the most frequently mentioned critical factors for enabling collaborating organizations and teams to both continue to work together and achieve projects over time. Several studies reveal that top management commitment and availability is crucial in inter-organizational collaborations (Casey & Richardson, 2006; Schreiner & Corsten, 2004; Ylitalo et al.,

2006). Dedekorkut (2004) found that effective leadership throughout collaboration is highly and positively related to commitment, trust, as well as success in terms of goal achievement, satisfaction and efficiency. Based on a sample of cross-functional new product development teams, Sarin et al. (2003) report medium correlations between effective leader support (in terms of demonstrating concern and fairness) and outcomes of team learning and speed to market of new product. The study of Lovelace, Shapiro, and Weingart (2001) in similar settings reveals high positive correlations between effective leadership (in reference to behaviors such as encouraging individual initiative, providing clear and complete performance evaluation feedback, maintaining a strong task orientation) and innovativeness (measured as number of innovations or new ideas introduced by the team, the team's overall technical performance, and the team's adaptability to change). However, it is important to nuance these findings in light of national contexts, trends, and preferences. Work autonomy and empowerment are viewed as strong motivational factors in individualistic cultures (Erez, 2010), suggesting that more flexible approaches such as support for autonomy may be preferred by some versus monitoring and structuring management by others. Positive feedback, on the other hand, appears to be universally perceived as generating a positive effect (Erez, 2010). As suggested by Gelfand et al., (2007), perhaps a crucial and universal role of leaders in such setting would be to help prevent communication breakdowns and broker hidden knowledge between culturally diverse collaborators.

Mediators – Group processes and emergent states

Goal clarity and similarity. The fundamental importance of clear mutually understood strategic purposes and objectives in complex collaborations is the most frequently reported success factor in our review. Clear and common goals increase motivation and commitment toward a project and its objectives (Higgins & Maciariello, 2004), provide a sense of inclusion, and stimulate member interactions fostering good working relationship. When parties have the same or overlapping goals and a clear understanding of these goals, it generates trust that they are working in synch with the collective project (Higgins & Maciariello, 2004), and reduces potential misunderstandings and conflicts (Blackburn, Furst, & Rosen, 2003). As different cultures often operate under different models of teamwork and thus, may have different expectations about collaboration (Gibson & Zellmer-Bruhn, 2002), providing and maintaining clear and common goals is paramount to foster effective collaboration. For instance, Oguntebi (2009) suggests that in international virtual teams, alignment of team goals and vision influences the interaction between group process enablers (referred to as communication, conflict resolution, team camaraderie, role allocation) and group performance. In a sample of interdisciplinary teams in hospital settings, Sicotte, D'Amour and Moreault (2002) found that conflicting disciplinary goals is strongly and negatively related to collaboration. In inter-organizational collaborations, this factor may help collaborators maintain proper focus and prevent them from adopting competing avenues. It is noteworthy that although goal clarity and similarity is mandatory at the onset of a project, it must be maintained throughout the collaborative

endeavor and is implied in effective collaborative processes. Through their interactive processes, collaborators need to keep track of these goals namely during coordination and planning activities, as well as maintain consensus on initial goals or establish new ones when adaptive measures are required.

Rules and procedures. Formalization of rules and procedures for actions and interactions in complex collaborations is essential. The terms of the collaboration should be mutually agreed upon among collaborators. If not, each may interpret situations based on their own principles, thus increasing the chances of conflict (Ylitalo et al., 2006). Rules give a firmer common ground to parties for collaboration and should be discussed and maintained at all levels. For instance, agreeing about the funds, objectives and schedules is necessary but insufficient; it is as important to agree how work is done in practice (Ylitalo et al., 2006) and how decisions are reached (Mankin & Cohen, 2004b). In international and inter-organizational collaboration contexts, clear norms and procedures as regards communications (frequency, means, cultural sensitivity) are considered specifically crucial (Armstrong and Cole 2002; Casey and Richardson, 2006; Mankin and Cohen, 2004b). Additionally, results from Dedekorkut's (2004) study in inter-organizational context reveals that mutual agreement on ground rules, decision-making process and scope of collaboration is positively and highly related to inputs (strong leadership), to processes (open communication), to emergent states (trust, commitment and good relationships) and to project outcomes (goal attainment, satisfaction and efficiency). Based on their case studies pertaining to collaboration across national boundaries, Armstrong and Cole (2002) posit

that some members with different national cultures can establish closer work cultures than some members that are very close nationally and geographically but be very different in work culture. They conclude that the most important culture for work groups is that related to clear work roles, procedures and methods for collaborating across distance. Jap (2001) also found that process clarity is positively and moderately related to collaboration success in terms of outcome achievement, outcome fairness and willingness to collaborate in future. In interdisciplinary context, moderate positive correlations have also been reported between clear rules and procedures in team activities and team learning, speed to market and product innovation (Sarin & McDermott, 2003).

Communication. This process is more exhaustive than other factors, as various elements of communication are crucial to foster success of complex collaborations and communication is implied in other processes. Detailing of preponderant elements is thus required. Globally, communication refers to the process of transferring information, meaning and understanding from sender to receiver (Gibson, 1996) and is fundamental to any form of organizing (Gibson & Manuel, 2003). It allows cooperation among team members, yields insightful information about members' personal characteristics, lays grounds for developing common values and norms, and fosters continued interaction. Frequent communications promotes efficiency by hindering misunderstandings or conflicts that slow work processes, helps build personal relations and strengthens a shared understanding of various perspectives (Klein & Kleinhanns, 2003), a preponderant issue in complex collaborations. Communication is critical in complex collaborations to allow

parties to exchange across distances, time, organizations and nations (O'Hara-Devereaux & Johansen, 1994, in Gibson & Manuel, 2003). However, the greater the cultural differences between sender and receiver, the more difficult communication will likely be, namely in terms of interpretation and understanding allowing for proper attribution. Clarifying words and concepts in intercultural contexts is mandatory (Oguntebi, 2009). In addition, many teams involved in complex collaborations resort to virtual communication at various extents. Global teams, for instance, usually lack physical interactions and must resort to communication mediums of varying richness. A rich communication medium (e.g., including social, non-verbal and feedback cues) reduces ambiguities and uncertainties and facilitates mutual understanding as opposed to less rich media. Face-to-face communication is considered as most effective, followed by videoconference (synchronous visual and auditory cues), phone (synchronous auditory cues), and text-based systems, such as e-mails and messages (no visual and auditory cues) (Axtell, Fleck, & Turner, 2004). The communication medium should be chosen depending upon the ambiguity of the information to be transferred; highly ambiguous information should preferably be conveyed via rich synchronous medium, while lower ambiguity information can more readily be transmitted through less rich asynchronous communication (Patrashkova & McComb, 2004).

Not surprisingly, numerous researches have emphasized the upmost importance of effective communication in complex collaborations. Some authors stress that frequent face-to-face contacts are significant predictors of collaborative success (Armstrong & Cole

2002; Schunn et al., 2002). Interestingly, Espinosa et al. conclude that "it is not so much face-to-face communication that is vital to international project success, but rather the ability to interact synchronously and interactively when needed" (2006: 362), especially for more complex projects with highly interdependent tasks, which require increased communication incidents. However, consistent with other authors such as Oguntebi (2009), they add that face-to-face meetings held early during the project are especially effective when global project teams consisting of people from different cultures are working on critical, complex tasks. In inter-organizational collaboration context, Dedekorkut (2004) found that open communication is positively and highly correlated with good relationship, power and decision making equity, trust and commitment and moderately to highly correlated with goal realization, satisfaction and efficiency. Communication openness through freedom to express doubts has also shown to moderate the task disagreement-performance relationship (Lovelace et al., 2001). Osman's (2004) study in inter-organizational context reveals that cooperative information sharing is positively and strongly correlated with the strength of relationship (i.e., good relationship) and to trust, and is an important predictor of quality and lower cost. Constant convey and dissemination of knowledge and information between partner organizations also emerged as key capability in case studies of Schreiner and Corsten (2004).

Coordination. Coordination refers to "the process of orchestrating the sequence and timing of interdependent actions" (Marks et al., 2001: 367). It includes the combination of disparate team-member actions and effort, and such combination process involves temporal

entrainment as well as synchronization (Kozlowski & Bell, 2003). Coordination can be both explicit and implicit (Chiocchio et al., in press). The former refers to concrete communication among team members on information revealing which individuals must carry out which tasks, while the latter involves anticipating needs of others and adapting to situations as well as to one another without using explicit coordination means (Salas & Fiore, 2004). Coordination is required to align efforts with projects goals and objectives (Kerzner, 2003) and helps prevent ambiguity in roles and responsibilities between partner organizations (Casey, 2006). Well defined roles and responsibilities early in the collaborative endeavor empower and commit the parties, and enable to better understand and clarify the tasks needed in the collaborative relationship (Ylitalo & al., 2006). Anderl, Völz, Rollmann, and Lee stress that "coordination is needed to structure distributed and interdisciplinary teamwork in the planning of time schedules, work processes and milestones as well as in networking knowledge, expertise, information and data." (2009: 167). In a study on collaboration across disciplines and organizations, Cummings and Kiesler (2005) report that projects using more coordination mechanisms are more successful that those that used fewer. Based on a sample of 42 interdisciplinary teams, Peter and Fletcher (2004) found that quantitative outcomes such as quality, productivity, and profitability were enhanced when teams had greater coordination and goal alignment. Espinosa, Delone and Lee (2006) report that, in global virtual teams, when international boundary issues make it difficult to communicate, efficient teams adopt alternative coordination mechanisms such as task programming. They add that coordination through

task programming was the most frequently discussed process adopted to overcome barriers imposed by global boundaries.

Conflict management. When people with different values, expertise, backgrounds and cultures work together, conflict and tension can arise. Hence, such diversity increases the occurrence of task and affective conflict because it "prompts different perspectives on, and approaches to, work and fuels different attitudes, beliefs and expectations." (Hinds & Bailey, 2003: 618). Conflict can also arise over whose knowledge and meanings are privileged, especially in interdisciplinary contexts (Bagshaw et al., 2007). Hobman, Bordia and Galois (2003) found that higher value dissimilarity is related to higher task and relationship conflict and lower information exchange, collaborative decision making and perceived feeling of respect and listening. Collaborators need to acknowledge that problems will occur and that they must be communicated and dealt with productively and constructively, respecting and exploring diversity of perspectives. Under certain conditions, disagreement may be beneficial to generate brainstorming, new ideas, knowledge exchange and learning (Jehn, 1995; Lovelace et al., 2001), but it should not magnify into lasting or escalading conflict threatening the overall project and performance. Team synergy and viability largely depends on effective forms of conflict resolution (Hollaender et al., 2008), which should be open and perceived as fair (Gibson & Manuel, 2003). Osman's (2004) inter-organizational study identifies collaborative conflict resolution during collaboration as one of the strongest predictors of achieving desired schedule, budget and quality performance outcomes. This factor is also positively and highly correlated with good

relationship, effective information sharing and trust. Based on their international research collaboration experiences, Bagshaw et al. stress that "unless the focus on teamwork, collaboration, and managing the inevitable conflicts that arise is deliberate and thoughtful, both the processes and outcomes may be superficial or even fraught with struggle and damage." (2007: 433).

Regular evaluation and monitoring. As relationships and projects progress throughout the life of the collaborative endeavor, collaborators need to review their situation. Ylitalo and collaborators (2006) stress that the collaborative relationship should be assessed both at strategic and operational levels, and that without regular evaluation, possible business and learning opportunities can be missed, trust may decrease, and misunderstandings arise. Blackburn et al. (2003) indicate that some performance measures cease to provide useful information as teams evolve, and therefore, such measures should be regularly audited to assess if they remain useful in light of the project stage and team maturity. Osman's (2004) study in inter-organizational context reports high positive correlations between process assessment (e.g., activities, performance indices related to relationship, cost/budget monitoring) and resource commitment. Case studies from Mankin and Cohen (2004a, 2004b) also stress the upmost importance of regularly monitoring progress and conditions, and if required, adapting to unexpected changing circumstances and learned experience by modifying project goals, expectations and plans. They state that in the case of long-term collaborative endeavors, this may be the most crucial factor to achieve success.

Trust. "Trust is to have confidence or faith in someone that is based on a probabilistic expectation that they will act in certain ways, and that these ways will be in conformance with a mutually shared interest, rather than be self-interested in a way that does not take account of the expectations, needs and desires of these others" (Pitsis, Kornberger, & Clegg, 2004: 58). Expectations are based on previous experience as trust building is a cyclical process (Chiocchio, 2005), in the sense that "with each positive outcome, trust builds on itself incrementally, over time, in a virtuous circle" (Vagen & Huxham, 2003: 8). When team members do not trust each other, they tend to move away from each other, cognitively, affectively and physically (Bagshaw et al., 2007), hindering effective collaborative processes and positive emerging states, and ultimately team and project performance. Trust is considered by many authors as the most important element of a good working relationship (Bagshaw et al., 2007) and has been reported as critical success factor of complex collaborations in numerous studies. In work that requires crossing national, organizational, and disciplinary boundaries, "lack of trust may be the most daunting boundary of all [as it] creates inefficiency, blocks commitment, and inhibits change" (Mankin, Cohen, & Bikson, 1996: 248). Gibson and Manuel (2003) provided evidence that teams with greater national, organizational and disciplinary cultural differences where characterized by greater proportion of negative expressions of trust than teams with fewer cultural differences. Regarding results from this literature review, Osman (2004) reports high positive correlations between trust and strong relationships, effective conflict resolution and information sharing and indicates that trust among collaborators

from different organizations is one of the strongest predictors of achieving desired performance in terms of schedule, budget and quality. Dedekorkut's (2004) study reveals that trust is positively and highly related to open communication, commitment and good relationship and as well as moderately to highly related to goal achievement, satisfaction, and time/resource efficiency. Similar results for effectiveness and satisfaction have also been found in global virtual teams (Edwards & Sridhar, 2003). In international partnership samples, Jean et al. (2010) found that trust is positively and highly correlated with market performance in terms of increased sales growth, market sales and profitability.

Commitment. "Commitment refers to a sense of duty that the team feels to achieve the project's goals and to the willingness to do what's needed to make the project successful" (McDonough, 2000: 226). Small to medium positive correlations between project commitment, coordination, and teamwork quality have been demonstrated in a longitudinal study by Hoegl, Weinkauf and Gemuenden (2004). Teams experiencing positive team processes such as effective communication, cooperation and goal similarity are likely to develop strong commitment to overall project (Chiocchio & Lafrenière, 2009). Equally, when team members feel committed to a project, through sharing of superordinate goals, they are motivated to cooperate, exchange information and achieve success of the project. High degree of commitment of team members has been identified as a key feature of high-performance global multicultural teams (Matveev & Milter, 2004). In addition, Dedekorkut (2004) found that collaborators' commitment to collaboration is positively and strongly correlated with project success measured as satisfaction, goal realization, and time

and resource efficiency.

Harmonious interpersonal relationships. Given collaborative endeavors occur through the interaction of people, success in collaboration is highly dependent on the bonds that unite them. Smooth, harmonious interpersonal relationship facilitates collaboration and reduces uncertainty (Jap, 2001). In difficult situations, good interpersonal relationships can be a support to get over the turbulent moments (Ylitalo et al., 2006), acting as a pathway to overcoming numerous obstacles to project success. Doz and Hamel (1998) suggest that good relationship building may be more important than a fine design of the partnership in strategic alliances. Although this factor is not clearly defined in reviewed studies, it was so frequently mentioned that we could not avoid including it in this review. The prevailing notions in these studies mostly relate to getting along well, and the absence of conflicts and tensions between collaborators. Hence, harmonious relationship usually pertains to states such as getting along well, absence of lasting conflict, and social cohesion through development of personal ties, bonds of friendship, enjoyment of other's company, for instance (Chiocchio & Essiembre, 2009). Building close personal relationships and forming psychological contracts between members of the partner firms has been reported to be stronger glue than any formal contract (Ring & Van de Ven, 1994). Dedekordut's (2004) empirical study on inter-organizational collaborations reports that good interpersonal relationships are positively and highly related to subjective and objectives measures of performance and to processes and emergent states, as reported in previous sections of this article. Ylitalo et al. (2006)'s case studies reveal that good relationship between key

individuals crossing the organizational boundary is considered fundamental for successful collaboration. On the contrary, conflicts and misunderstandings are negative factors hindering interpersonal relationships and thereby collaboration (Ziegler, Ylitalo, & Mäki, 2004), thus the importance of effective conflict management processes and high openness to diverse viewpoints, values and methods. In interdisciplinary teams, Peter and Fletcher (2004) found that quality, productivity, and profitability are enhanced when teams are cohesive. Osman (2004) found that strength of interpersonal relationship was the strongest predictor of achieving desired outcome in terms of quality, cost, delay and profit and that it was also positively and highly correlated with trust, cooperation and conflict resolution in inter-organizational partnership.

Discussion

The present article aimed to advance knowledge in the diffuse and otherwise understudied field of complex collaborations. As demonstrated in this paper and as stressed by some authors (e.g. Mattessich, Murray-Close, & Monsey, 2001; Osman, 2004), although this topic raises increasing interest, there is little empirical studies on factors promoting success and positive outcomes of such collaborative endeavors, and no exhaustive literature review encompassing all three key collaboration contexts inherent to this construct has been conducted to date. Our purpose was to address this problem and elucidate what the past 10 years of research on complex collaborations can tell us about the individual, team and

organizational factors that contribute to their effectiveness and success, and based on that knowledge, to identify leverage points that can be used to promote these positive outcomes. Our exhaustive literature review bridging insights from various domains and complexity contexts allowed us to identify 14 factors from 26 pertinent and valid qualitative and quantitative studies.

One can see from Table 1 that 12 out the 14 factors have been reported across all three key contexts of complex collaborations. This concurrence suggests that they share the common ground and challenges of presence of cultural diversity, and that these challenges may be addressed through similar measures and conditions, whether diversity is inherent to nations, organizations or disciplines. This finding is paramount given types of cultural diversity often do and will increasingly overlap in complex collaborations, as organizations are faced with increasingly complex problems, global competition and innovation needs, thus seeking and capitalizing on required knowledge, competencies and resources wherever they can be found – whether across national, organizational and/or disciplinary boundaries (Cohen & Mankin, 2002).

A closer examination of findings reveals that whatever the context, some variables appear to receive greater recognition than others. Hence, the most frequently reported factors pertain to effective group processes: goal similarity and clarity, as well as communication and coordination. This is a positive and constructive insight as these elements can be worked on and managed, through conventional practical team building interventions, for instance (Sundstrom, DeMeuse, & Futrell, 1990). Such effective

processes play a major role in reducing ambiguity, uncertain work characteristics exacerbated by cultural diversities, that make it difficult for collaborators to understanding each other (Lovelace et al., 2001). Hence, clear structuring mechanisms, enabled through effective communication, reduce ambiguity and facilitate the formation of a shared meaning system and potentially common group identity, even if initial cultural disparities between collaborators may have originally inclined them to operate under different models of teamwork with different expectations about the collective endeavor. It is noteworthy that some of the questions raised in recent literature pertain to the need to address conditions that help to create hybrid cultures in intercultural encounters as well as ways in which people negotiate and manage their cultural differences to increase positive outcomes for individuals and organizations (Gelfand et al., 2007). Findings from our literature review provide promising avenues for this latter issue.

As opposed to the three previously mentioned factors, conflict management is the least frequently reported factor, and it is entirely omitted in studies related to international endeavors. However, given conflicts are so often reported as a major issue and barrier to complex collaborations, it seems logical that effective conflict resolution/management is required in such setting. A plausible explanation to this scarcer reporting is that perhaps when all other factors are present in the collaborative endeavor, conflict seldom occurs or prevails, and thus its management rarely required. It is also possible that the frequency at which the variables are reported does not necessarily reflect their importance. Hence, various authors have focused their investigations on a conundrum of theories and premises,

and it is likely that due to their diverging focuses, some factors have received little or no attention. Regular evaluation and monitoring is another factor that has not been found in all three contexts, as it is absent in interdisciplinary collaboration context. Perhaps it is mainly reported and more salient in larger-scale and lengthier endeavors/projects requiring rigorous control, or those involving external partners exerting greater surveillance on each other's activities, as opposed to intra-organizational routine processes. It may also be that, as previously mentioned, monitoring has simply not received much attention by scholars studying interdisciplinary context. Most importantly, studies on complex collaborations seldom describe all diversity within samples. Hence, while elements of internationality, inter-organizationality and interdisciplinarity are clearly not mutually exclusive, studies tend to highlight one specifically without much (or any) emphasis on other potentially present ones. For instance, international collaborations inextricably imply national cultural diversity and oftentimes interdisciplinary diversity, but the latter is not addressed. Hence, most collaborative projects in global settings are rather complex and require a rich pool of knowledge, skills, and abilities, translating into the need for cross-functional expertise (Chiocchio & Essiembre, 2009; Kerzner, 2003). The same comment applies to inter-organizational collaborations. Interdisciplinarity attributes are likely much more frequent in these studies than stated.

In this light, future research should investigate the interplay of these dimensions as regards the influence or weight of different factors identified in this paper. For instance, when collaboration involves all three types of diversity (international, inter-organizational

and interdisciplinary), is the relationship between variables the same as when only one is present? Do some variables have a greater impact depending on the type of diversity at play? Same questions could also apply when adding other elements of diversity, such as age, gender and tenure, for instance, as these have also been reported to negatively impact group dynamics and outcomes (Gist et al., 1987; Levine and Moreland, 1990; Zenger and Lawrence, 1989, in Rentsch & Klimoski, 2001). As raised by Shore et al., scholars must "move beyond old paradigms and limited ways of thinking to develop integrative and practical diversity theories that help organizational leaders create systems in which diverse human beings are able to thrive, and to help their organizations do likewise" (2009: 129). Beyond diversity, such inquiry is also relevant as regards the impact of other potential constraining or opportune contexts (Johns, 2006). Hence, we have demonstrated that contexts of social structure and task ambiguity can be moderated by several factors. In parallel, specific compositional factors have been identified in literature review has having a significant impact on the relationship between team diversity and performance, namely team type, team size, task interdependence, and frequency and duration of member interactions (Horwitz, 2005). These and other factors (such as political, economic, and legal factors, degree of virtuality, and communication technology, for instance) likely influence the particularities in dimensions and applications of facilitating factors identified in this article. The study of their interplay's influence on outcomes, attitudes and behaviors is a needed wave for the future, as context affects how people think, feel, and interact (Kozlowski & Klein, 2000). Also, collaboration is a dynamic and constructive process,

which unfolds over time and evolves to adjust to the changing conditions within and outside the collaborative endeavor (Hartono, 2004), and involved collaborators continuously learn and adapt throughout performance achievement (Kozlowski, Gully, Nason, & Smith, 1999). Therefore, targeted interventions are appropriate at various points in time to reduce constraining contexts, thus emphasizing the need for research agendas with longitudinal designs allowing to identify crucial intervention periods pertaining to various success factors.

This being said, and in line with above comments, it is important to emphasize that the present review aims to illustrate factors fostering success of complex collaborations in a generalizable manner – it does not aim to provide detailed specifications of case-by-case situations. Each variable reported herein likely comprises specific sub-dimensions according to specific situations. Further research is needed to delve more deeply into each factor identified according to situational specificities.

Concluding remarks

To address challenges of more complex 21st century world, characterized by the knowledge economy, technological prevalence and advances, new working arrangements, increasingly complex tasks, as well as globalized competition and markets, complex collaborations are increasingly on the rise (Fitzgerald, 2004; Mankin & Cohen, 2004a). The growing prevalence of complex collaborations and reliance on working groups or teams

involved in them creates a scientific and practical imperative to understand the factors that promote their effectiveness and success. We presented an exhaustive review of evidence-based literature on the subject by cutting across silos of disciplines and contexts, allowing for definition of similarities and contrasts between international, inter-organizational and interdisciplinary contexts, and generated dynamic description of facilitating factors, while explaining their value and impact in light of complex work settings. We provide research avenues for a better understanding of dynamics at play between variables, and propose targets for practical interventions to improve conditions that foster success of complex collaborations, which are oftentimes costly in terms of financial as well as human resources. In closing, as globalization of the world economy increasingly impels organizations to seek out markets, supplies, technologies, and human resources across abovementioned contexts, the principle of complex collaboration success and efficacy is not a passing trend, but will rather continue to be pertinent in years to come, and the presented findings may prove highly useful and long-lasting.

We hope our efforts to integrate research across disciplines, contexts, oftentimes atheoretical bases, and mixed terminology will encourage other academics to further study collaboration through a better understanding of the interplay of interdisciplinary, inter-organizational, and international contexts.

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Footnotes

[1] As do other authors (ex: Kozlowski & Bell, 2003; Kozlowski, Gully, Nason & Smith, 1999), we use the terms group and team interchangeably in this article. Hence, for our purposes, the primary issue is not the terms per se, but in what contexts collectives evolve. Referring to definitions of Campion, Medsker, & Higgs (1993) and of Salas, Stagl, & Burke (2004), both constructs may apply to collectives involved in complex collaborations. Campion et al. (1993) view a work group as comprised of individuals sharing a commitment towards a common goal. Salas et al. (2004) define teams as unique entities characterized by two or more individuals, interacting socially, adaptively, having shared goals, holding meaningful task interdependencies, and having a limited life-span, whose expertise and roles are distributed and are embedded within a dynamic environmental/situational context that influences and is influenced by team, inputs, processes, and outcomes. However, as stressed by Tannenbaun, Mathieu, Salas, & Cohen (in press), several definitions of teams no longer reflect contemporary reality, given the nature of teams and the environment in which they operate has changed, the latter being more fluid, dynamic, and complex than in the past. We agree with these authors' observation.

[2] Readers may refer to work of Harrison and Klein (2007) for considerations on assessing degrees of diversity related to various types of diversity, as well as to those of Thatcher & Patel (2011) and Zanutto, Bezrukova, & Jehn (2001) for specifications related

to faultlines (i.e., simultaneous multiple diversity types).

[3] Ilgen et al.'s (2005) model is an evolution from the traditional Input-Process-Output model to account for the various features of processes. In the IMOI model, processes not only include cognitive and behavioral processes but also emergent cognitive and affective states. Processes are members' interdependent acts that convert inputs to both proximal and long-term outcomes "through cognitive, verbal, and behavioral activities directed toward organizing task work to achieve collective goals" (Marks et al., 2001: 357). They refer to the nature of members' interaction and include activities such as planning, evaluation, management, monitoring and coordination, (Marks et al., 2001; Salas et al., 2009). Process mediators are classified in two categories in this article: structuring/monitoring processes and collaborative processes. States generally refer to people's attitudes, values, cognitions, and motivations. In parallel, emergent states arise when aforementioned individual-level states come to represent team-level phenomena through interactions between individuals over the life of the team to impact individual and team outcomes (Kozlowski & Klein, 2000; Marks et al., 2001; Ilgen et al., 2005). The additional "I" at the end of the model pertains to the notion of cyclical causal feedback, indicating outcomes can also recycle into inputs as teams accomplish goals and subgoals of their tasks. Team processes, emergent states and outcomes are progressively and incrementally enhanced through each cycle. Readers may refer to work of abovementioned authors for further descriptions of principles pertaining to this model.

Table 1.
Factors Fostering Success of Complex Collaborations Reported in Empirical Studies

Variables	International Context		Inter-organizational Context		Interdisciplinary Context	
	Qualitative studies	**Quantitative studies**	**Qualitative studies**	**Quantitative studies**	**Qualitative studies**	**Quantitative studies**
Openness to diversity	Akkerman et al. (2006); Mankin & Cohen (2004)[a]; Matveev & Milter (2004)		Mankin & Cohen (2004)[a]		Hara et al. (2003); Kessel et al. (2003)	Kalam (2008); Peters & Fletcher (2004)
Complementary abilities/expertise	Mankin & Cohen (2004)[a]; Matveev & Milter (2004)		Mankin & Cohen (2004)[a]		Hara et al. (2003); Kessel et al. (2003)	
Equity	Matveev & Milter (2004)	Schunn et al. (2002)	Schreiner & Corsten (2004)	Dedekorkut (2004); Jap (2001)		Sarin et al. (2003); Sicotte et al. (2002)
Supporting infrastructure	Mankin & Cohen (2004)[a]; Matveev & Milter (2004)		Casey & Richardson (2006); Mankin & Cohen (2004)[a]; Schreiner & Corsten (2004); Ylitalo et al. (2006)	Dedekorkut (2004); Osman (2004)	Kessel et al. (2003)	
Management/leader support	Mankin & Cohen (2004)[a]		Casey & Richardson (2006); Mankin & Cohen (2004)[a]; Schreiner & Corsten (2004); Ylitalo et al. (2006)	Dedekorkut (2004)	Kessel et al. (2003)	Lovelace et al. (2001); McDonough (2000); Sarin et al. (2003); Sicotte et al. (2002)
Goal similarity and clarity	Akkerman et al. (2006); Armstrong & Cole (2002); Espinosa et al. (2006); Mankin & Cohen (2004)[a]; Matveev & Milter (2004); Oguntebi (2009)		Casey & Richardson (2006); Mankin & Cohen (2004)[a]; Ylitalo et al. (2006); Ziegler et al. (2004)	Dedekorkut (2004)	Kessel et al. (2003)	McDonough (2000); Sicotte et al. (2002)
Variables	**International Context**		**Inter-organizational Context**		**Interdisciplinary Context**	
	Qualitative studies	**Quantitative studies**	**Qualitative studies**	**Quantitative studies**	**Qualitative studies**	**Quantitative studies**

Rules and procedures	Armstrong & Cole (2002); Espinosa et al. (2006); Mankin & Cohen (2004)[a]		Casey & Richardson (2006); Mankin & Cohen (2004)[a]; Ylitalo et al. (2006)	Dedekorkut (2004); Jap (2001)		Sarin et al. (2003)
Communication	Armstrong & Cole (2002); Espinosa et al. (2006); Mankin & Cohen (2004)[a];Matveev & Milter (2004); Oguntebi (2009)	Schunn et al. (2002)	Mankin & Cohen (2004)[a]; Ylitalo et al. (2006); Schreiner & Corsten (2004); Ziegler et al. (2004)	Dedekorkut (2004); Osman (2004)	Hara et al. (2003); Kessel et al. (2003)	Lovelace et al. (2001)
Coordination	Armstrong & Cole (2002); Espinosa et al. (2006); Mankin & Cohen (2004)[a]; Matveev & Milter (2004); Oguntebi (2009)	Edwards & Sridhar (2003);	Cummings & Kiesler (2005)[b]; Mankin & Cohen (2004)[a]; Schreiner & Corsten (2004); Ziegler et al. (2004)	Jap (2001); Osman (2004)	Cummings & Kiesler (2005)[b]	Peter & Fletcher (2004); Sarin et al. (2003); Sicotte et al. (2002)
Conflict management				Osman (2004)	Kessel et al. (2003)	Lovelace et al. (2001)
Regular evaluation and monitoring	Espinosa et al. (2006); Mankin & Cohen (2004)[a]		Mankin & Cohen (2004)[a]; Ylitalo et al. (2006)	Osman (2004)		
Trust and respect	Mankin & Cohen (2004)[a]	Edwards & Sridhar (2003); Jean et al. (2010)[a]	Mankin & Cohen (2004)[a]; Ziegler et al. (2004)	Dedekorkut (2004); Jean et al. (2010)[a]; Osman (2004)	Hara et al. (2003); Kessel et al. (2003)	McDonough (2000)
Commitment	Armstrong & Cole (2002); Matveev & Milter (2004)			Dedekorkut (2004)	Hara et al. (2003); Kessel et al. (2003)	McDonough (2000)
Harmonious interpersonal relationships	Oguntebi (2009)		Schreiner et Corsten (2004); Ylitalo et al. (2006); Ziegler et al. (2004)	Dedekorkut (2004); Osman (2004)	Hara et al. (2003)	Kalam (2008); Peters & Fletcher (2004); Sicotte et al. (2002)

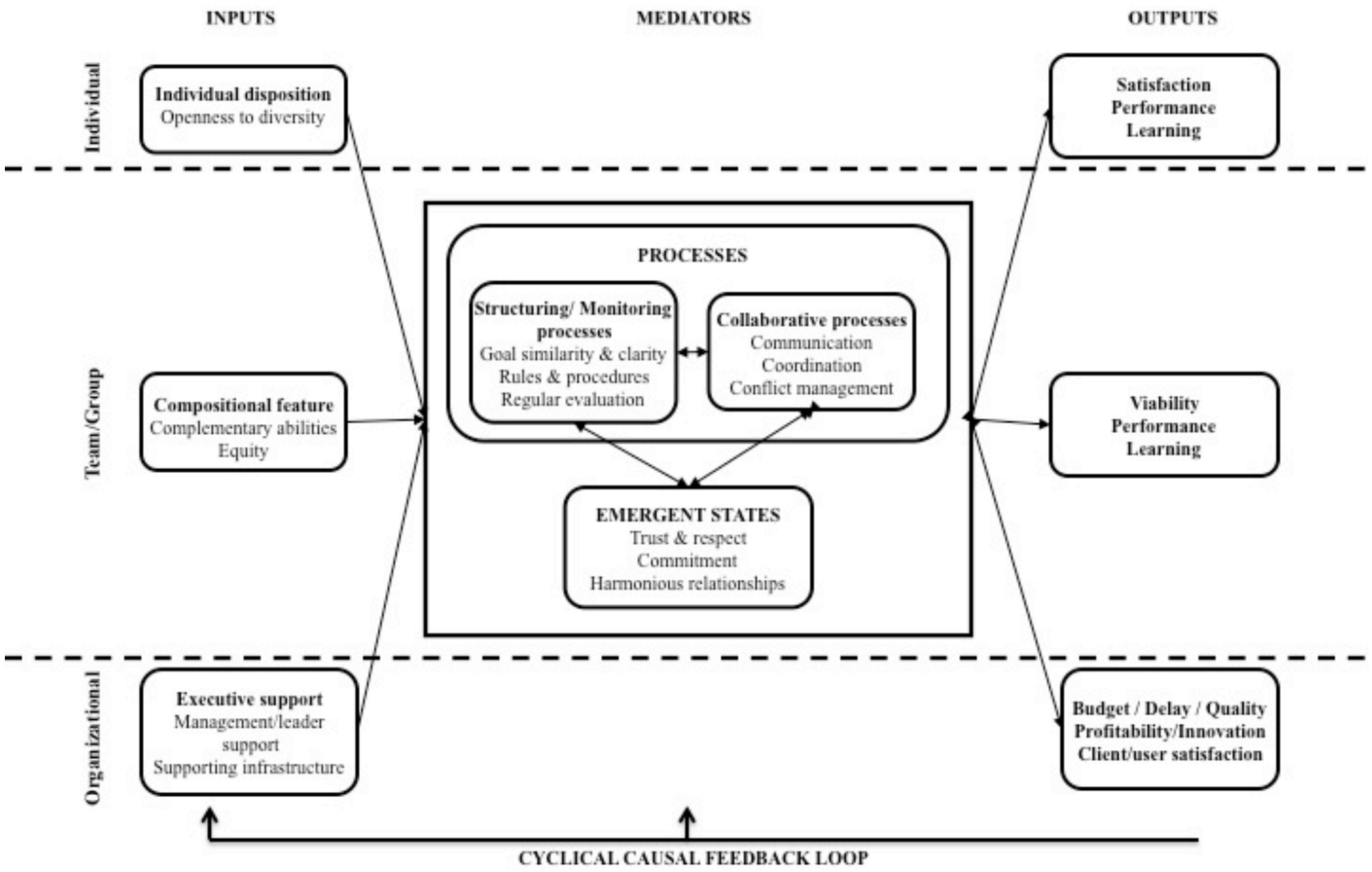

Figure 1. Model of effectiveness of complex collaborations

Determinants of viability, team and project performance in integrated design teams: An examination of complex collaborations

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Abstract

This study explores whether the relationship between openness to diversity and specific team outcomes is mediated by team dynamics pertaining to efficient collaborative processes and conflicts. The multi-wave survey was conducted with 16 integrated design projects teams (*N*=93) participating in intense work sessions aimed at producing innovative design concepts, illustrative of complex collaboration context. Results support the overall hypothesis that greater openness to diversity affects viability, team performance, and project performance by way of promoting efficient collaborative processes and inhibiting conflicts.

Key Words: *Complex collaborations, interdisciplinary teams, inter-organizational teams, integrated design, collaborative processes, conflicts, viability, performance*

Determinants of viability, team and project performance in integrated design teams: An examination of complex collaborations

Although complex collaborations have been proliferating in the last two decades (Fitzgerald, 2004) and the academic community's interest towards these collaborations is ever increasing (Gray, 1991; Rivera, 2003), there are scarce empirical studies on factors fostering their success. Many writings consist of anecdotal reports and conceptual papers, as well as some qualitative studies, which mainly delve on challenges as well as negative dynamics and outcomes associated with these endeavors. In addition, the few quantitative studies on the subject largely present simple relations between variables, not models that simultaneously assess multiple meditational factors affecting performance outcomes of complex collaborations.

Complex collaborations are a form of collaboration characterized by moderate to high diversity in national, organizational and/or disciplinary cultures of oftentimes unfamiliar collaborators working together on complex, ambiguous, non-routine tasks involving uncertain outcomes. Hence, diversity, whether in terms of national, organizational or disciplinary culture, is the core feature of these collaborations. Diversified workforce is increasingly sought by organizations to achieve innovation, solve problems and reach enlightened decisions, especially through interdisciplinary work groups (Homan, Van Knippenberg, Van Kleef, & DeDreu, 2007) and inter-organizational partnerships

(Ylitalo, Maki, & Ziegler, 2006). In such contexts, openness to diversity – in the sense of awareness and appreciation of differences in various trainings, experiences, practices, beliefs and viewpoints – is therefore crucial. However, there are many breaches in the study of this construct. For instance, most research have been conducted with students taking part in factual surveys unrelated to academic or work tasks (but rather analyzing openness to diversity against demographic variables, background and environment characteristics), solely assessed the construct as a dependent variable, and used individual-level data to discuss team-level constructs – a serious problem that must be avoided (Kozlowski, & Klein, 2000). Openness to diversity has almost never been studied as an independent variable in relation with significant team performance outcomes, and much less in a multiple mediation model that simultaneously accounts for team dynamics reported as critical in complex collaborations, such as collaborative processes and conflicts. Hence, previous research on complex collaborations have alleged that efficient collaborative processes, namely through reciprocal and pertinent information exchange, role and task coordination and synchronicity, as well as conflicts pertaining to affective and work dimensions, have important impacts on team outcomes (Beyerlein, Johnson, & Beyerlein, 2004; Casey, 2008; Chiocchio, Forgues, Paradis, & Iordanova, in press; Cummings & Kiesler, 2005; Dedekorkut, 2004; Schruijer, 1999). However, to our knowledge, no studies have yet investigated their concurrent effect on the relationship between openness to diversity and significant team outcomes. Furthermore, multiple mediation modeling provides a richer approach than simple mediation, and enables to decipher individual mediating effects that are often attributable to several potential mediators with possibly

overlapping contents (Hayes, Preacher & Myers, 2011; Preacher & Hayes, 2008a).

In light of these shortcomings, the purpose of this article is to advance knowledge on factors promoting success of complex collaborations through five significant contributions. First, we suggest hypotheses involving the interplay of factors of openness to diversity, collaborative processes and conflicts, in relation to important team outcomes. Second, and most specifically, we investigate collaborative processes and conflicts as competing mediators in the relationship between perceived group openness to diversity and three team outcomes: viability, team performance and project performance. Third, by using different measurement methods, we address the important issue of assessing internal (i.e., self-reported) and external (i.e., independent rater's assessments) performance indicators, and access different, yet equally important team outcomes (Sundstrom, De Meuse, & Futrell, 1990). Fourth, we focus our attention on integrated design teams, an understudied type of team important to the architecture, engineering, and construction industries, comprised of members from different professions and backgrounds delivering hands-on work requiring creativity and/or technical innovation (Devine, 2002; Reed & Gordon, 2000). Consequently, the samples and structure of these teams enabled us to control for the variables identified as having a significant impact on studies investigating issues related to diversity-performance relationships, that is, team type, team size, task complexity, task interdependence, and frequency and duration of member interactions (Horwitz, 2005). Fifth, we assess data at the team level, rather than at the individual level, as to adequately decipher group phenomena in light of studied variables.

We begin the article by depicting the overall concept of complex collaborations, and subsequently describe the context of integrated design teams taking part in sustainable development endeavor and how such context is illustrative of complex collaborations. Then, we outline the rationale underpinning our model, by describing the mediating variables (i.e., team collaborative processes and conflicts), the independent variable (i.e., team openness to diversity) and their interplay in predicting performance and viability. We follow by presenting results from our study, and conclude with a discussion on the latter as well as on observed theoretical and practical implications.

Complex collaborations: Key characteristics and challenges

Collaboration emerges in numerous settings and comes in various forms. In the past years, a new form of collaboration has rapidly grown to address contemporary 21st century challenges: complex collaborations. Complex collaborations occur when workers join forces in sharing and integrating knowledge across boundaries pertaining to national, organizational and disciplinary cultures (Cohen & Mankin, 2002). Such integration allows advantages of providing broader perspectives and pooled diversified resources, generating innovative ideas and solutions to multifaceted problems, and increasing competitive ability (Schunn, Crowley, & Okada, 2002; Reich & Reich, 2006). In parallel, working across boundaries and integrating different practices and worldviews creates high potential for ambiguity, misunderstanding, confusion, divergent goals, and conflicts, thereby increasing difficulties and risk of project failure (Mankin & Cohen, 2004a). Complexity inherent to such form of collaboration is primarily attributable to diversity in collaborative group

composition, which is typically further complicated by contextual elements of work-related ambiguity, uncertainty and novelty characteristic of project work (Turner, 2009).

Eloquently, diversity in collaborative work groups has often been qualified as a double-edge sword (Horwitz, 2005; Levine & Moreland, 2004), given studies associated it with both negative and positive effects on group processes and performance. Reported positive effects pertain to broader range of in-group knowledge, skills and contacts (Bunderson and Sutcliffe, 2002; Williams and O'Reilly, 1998), increased creativity and innovation (Cummings & Kiesler, 2005; Levine & Moreland, 2004), new understandings (Akkerman, Admiraal, Simons, & Niessen, 2006) and group performance (Stewart, 2006). Negative impacts are more frequently cited and apply to constrained mutual understanding, learning, information sharing and decision-making (Akkerman et al., 2006; O'Reilly, Caldwell, & Barnett, 1989; Williams & O'Reilly, 1998). Interpersonal conflicts, negative emotional reactions and poor integration are also elicited by group heterogeneity, inhibiting efficient communication and decreasing interaction among group members (Hobman, Bordia, & Gallois, 2004; Levine & Moreland, 2004) as well as group viability (Hackman, 1990). In their extended literature review, Williams and O'Reilly conclude that over 40 years of research reveals that "diverse groups are more likely to be less integrated, have less communication, and have more conflict." (1998, p. 115).

Other frequent components of complex collaborations, superimposed on diversity, pertain to ambiguity and uncertainty inherent to working with unfamiliar collaborators as well as to tasks and projects leading to new or improved products, processes, concepts or knowledge. These elements also present potential difficulties jeopardizing collaborative

efforts. Hence, given innovative projects are generally not prestructured or prescribed in routines, teamwork is more ambiguous (Molleman & Slomp, 2006). Characteristics of projects such as ambiguity and risk related to innovation induce stress (Nordqvist, Hovmark, & Zika-Viktorsson, 2004) and can trigger conflicts (Chiocchio, Lebel, Boucher, & Therriault, 2010). There may be greater confusion about roles, responsibilities, work arrangements and the project task per se, especially in highly autonomous teams (Molleman & Slomp, 2006). In addition, newly formed teams have no history of previous coordination patterns and tools, and members are oblivious of each other skills and competencies, thus potentially leery of others capacity to perform well. New collaborators are unfamiliar with each other's language, habits as well as cultural norms and sensitivities, which may lead to communication problems and less effective collaboration (Mankin and Cohen, 2004b).

Integrated design projects: Complex collaborations through interdisciplinary, inter-organizational and ambiguous contexts

Integrated design is an interdisciplinary participatory process specific to architecture, engineering, and construction bringing together specialists and key stakeholders during intensive work sessions—the number of which depends on the type of project, its size, and its complexity—in order to collectively resolve multifaceted, ill-defined problems related to and linking design and construction (Chiocchio et al., in press). This type of project (often called *charrettes* in design jargon) aims to address complexities inherent to sustainable development and design of high-performance (i.e., "green") buildings (Reed & Gordon, 2000). Integrated design work sessions usually last between

one to a few days and gather multiple professionals from various organizations and disciplines, such as architects, engineers, landscape architects, interior designers, and construction managers (Kibert, 2005), who are often unfamiliar with each other as they come from different organizations.

Particular features of integrated design teams relate to widely varying skills, experience and expertise brought by each party to the high-performance building design project, as well as ambiguity and risk related to producing innovation that could not be achieved individually (Reed & Gordon, 2000). In addition, teams are subjected to project management issues, such as deadline pressures and high technological standards (e.g., environmental quality, energy use, water, habitat and site issues) (Peeters, Van Tuijl, Reymen, & Rutte, 2007). All professionals work together as co-designers, are interdependent in their endeavor, have a joint ownership of the outcome of the project, and generally form an autonomous self-managed team.

While integrated design teams have the potential to generate new ideas leading to high-performance buildings, many of their inherent characteristics are what makes them complex, more difficult to manage, and prone to failure. As autonomous teams, they have the freedom to make decisions about "what," "when," "how," and "who" issues, but the fact that their processes are not routinized makes teamwork more ambiguous (Molleman & Slomp, 2006). Combination of team task ambiguity and urgent decision-making brought on by short deadlines is believed to jeopardize project performance (Molleman & Slomp, 2006). Members of integrated design teams are highly interdependent through interactive workflow and shared responsibility over project decisions. Such characteristics "increase

the amount and intensity of interaction among members, thus increasing the salience of conflicts that occur within a group" (Jehn & Benderski, 2003: 215). Moreover, team autonomy and task interdependence are believed to enforce the negative impact of team heterogeneity (Molleman & Slomp, 2006). While interdisciplinary composition of integrated design teams holds the potential of addressing complex problems in innovative ways and generating creative approaches, disciplinary and organizational boundaries, representing distinct cultural values, norms, processes, worldviews, and communication methods, complicate collaborative endeavors and threaten performance outcomes (Reich & Reich, 2006). Professionals from different disciplines tend to have different points of focus in integrated design teams (Reed & Gordon, 2000), and conflicting priorities as well as criteria of judgment and relevance can hinder attempts to collaborate across disciplines and reach consensus (Scaife, Curtis, and Hill, 1994; Pierce, 1999; Hollaender, Loibl, & Wilts, 2008).

Key factors of viability and performance in complex collaborations

Efficient collaborative processes

Team researchers agree that efficient team processes lead to increased team performance (Kozlowski & Bell, 2003). We believe these processes are particularly critical when professionals from different disciplines and organizations work together on a project, as they tend to have different ideas about the purpose of their joint efforts and work within various frames of reference while defining problems, reaching decisions, identifying tasks,

and assessing outcomes (Hollaender et al., 2008). Thus, to reduce ambiguity, misunderstandings, and unwarranted assumptions, and conversely, promote productive teamwork by aligning efforts with projects goals and objectives, efficient collaborative processes are mandatory. These processes are intertwined, and include "situation-appropriate uses of teamwork communication (i.e., rich bi-directional information sharing on tasks and good feedback), synchronicity (i.e., being on time with one's tasks and working in time with one another), and coordination (i.e., expressing and anticipating "who" does "what")" (Chiocchio, Grenier, O'Neill, Savaria, & Willms, in press). Hence, in teams reporting high teamwork quality, members openly communicate relevant information, coordinate their individual activities, and make sure that all teammates can contribute their knowledge to their full potential (Hoegl & Parboteeah, 2006). In innovative projects involving high levels of uncertainty and ambiguity, the ongoing need to collect and share information to resolve problems, reach decisions and promote shared understanding of various perspectives and of tasks is crucial (Klein & Kleinhanns, 2003; Sicotte & Langley, 2000). Additionally, when project team members are highly dependent on each other for information, materials, and reciprocal inputs, and are autonomous over task decisions and overall project, open information sharing and coordination of task activities should be increased to allow all to contribute their full potential (Hoegl & Parboteeah, 2006; Molleman & Slomp, 2006; Stewart, 2006). In dynamic task contexts, teams must readjust targets, milestones or processes, thereby exacerbating the need for efficient communication, coordination and synchronicity (Hinsz, Wallace, & Ladbury, 2009).

Significant positive relationships have been found between team performance and

team processes pertaining to information sharing and coordination, in workteams performing knowledge-intensive functions (Janz, Colquitt, & Noe, 1997). Hence, since cutting across organizations and disciplines can result in broadly delineated roles and actions of involved parties, coordination is particularly required to align efforts with projects goals and objectives (Kerzner, 2003) and prevent ambiguity in roles and responsibilities between teammates (Casey, 2008). Well defined roles, responsibilities and milestones early in the project empower and commit collaborators, and enable to better understand and clarify the tasks needed in the collaborative relationship (Ylitalo et al., 2006). Clear roles and responsibilities decrease ambiguity and complexity typically found in complex collaborations, reduce stress and foster relational bonding among collaborators, thereby increasing work effectiveness and efficiency (Sarkar, Aulakh, & Cavusgil, 1998; Schreiner & Corsten, 2004) as well as viability (Sundstrom et al., 1990). Interestingly, Stewart's (2006) meta-analysis on the relation between team design features and performance reveals that benefits of coordination on performance are greater for teams involved in complex and creative knowledge work – such as integrated design teams, for instance. In parallel, increased communication among team members has been found to be strongly associated with team viability in product development projects (Brodbeck, 2001). Sundstrom et al. (1990) further suggest that efficient intermember communication, coordination as well as clear norms and roles are precursors of team viability. Hence, efficiency in such important team processes creates favorable impression among team members that namely manifests as a willingness to engage in future collaboration together.

The preceding discussion leads us to postulate that in integrated design teams

H1: Efficient collaborative processes are positively related to team viability.

H2: Efficient collaborative processes are positively related to team performance.

H3: Efficient collaborative processes are positively related to project performance.

Conflicts

While efficient collaborative processes generate beneficial effects on team dynamics and performance, conflicts are mostly reported to induce negative effects (De Dreu & Weingart, 2003). In contexts where diversity pertaining to group composition is high, conflict is a major concern (Jehn, Bezrukova, & Thatcher, 2008). The building industry is prone to the emergence of conflicts, as illustrated namely by professionals' reticence in working with people of divergent views or different design disciplines (Rounce, 1998). As disciplines and organizations differ in the ways of assessing and framing problems, as well as selecting appropriate working methods, such diversity can lead to disagreement among team members about project direction and essential features (Hollaender et al., 2008) and over whose knowledge and meanings are privileged (Bagshaw, Lepp, & Zorn, 2007). Conflicts emerge with perceived incompatibilities or discrepant views among involved parties and evolve into behavioral reactions (Jehn & Bendersky, 2003).

Literature on conflicts generally divides this construct into two broad categories: affective or relational conflicts pertaining to manifestations of tension and annoyance

between team members, and work-related conflicts applying to disagreements on specific team activities and means to accomplish them. Regarding work-related conflicts, Jehn & Benderski (2003) have further divided them into task conflicts (i.e., conflicting viewpoints and disagreement about task content and issues) and process conflicts (i.e., debates about who should do what, resource allocations, task schedule), based on a literature review. In this respect, although the emerging consensus is that task conflict is generally unhelpful for teams (De Dreu & Weingart, 2003), some studies report possible benefits of task conflict in terms of strategic decision quality, planning and creative performance (Amason & Schweiger, 1994; Jehn, 1995; Schweiger, Sandberg Rechner, 1989; Mitroff, Barabba & Kilmann, 1977, in Jehn & Benderski, 2003), while nevertheless stressing its negative effects on group member satisfaction, viability and ability to reach consensus (Jehn & Bedersky, 2003). It is however important to point out that these studies pertain to *long term* partnerships, in which ideas may stagnate or potential inequities in decisional power inherent to informal norms and standards may develop over time. Conversely, in contexts of short-term, time bounded partnerships subjected to tight delays such as integrated design projects, task conflicts, as all conflicts, are likely counterproductive. Hence, it takes time for conflicts to resolve and for tensions to appease. We posit that they are too time and energy consuming for the short delay available to integrated design working sessions and may consequently be left unsolved or only partially solved. Conflicts involve a cycle comprising different phases. It is the effective collaborative management of the conflict that allows for task-related conflicts to potentially positively affect group innovativeness, not the conflict per se (Jenn & Bedersky, 2003). Furthermore, work-related conflicts, such as

task and process conflicts, co-occur with affective/relational conflict, especially when high-stakes decisions must be taken (De Church & Marks, 2001; Friedman, Tidd, Currall, & Tsai, 2000). Eloquently, Simons and Peterson's (2000) literature review reveals moderate to strong correlations between global work-related and affective conflicts in 10 of the 11 identified studies, further suggesting their co-occurrence. Most importantly, De Dreu and Weingart's (2003) meta-analysis concludes that task and relationship conflicts are not differentially correlated with team performance, even when controlling for group task complexity and nonroutiness, thus supporting on the one hand that all types of conflicts have an important contribution in negatively affecting team performance, and on the other hand, suggesting that "types" of conflicts might not be as clear cut of a construct as initially suggested (Tjosvold, 2008).

In sum, we posit that for heterogeneous teams such as integrated design teams, all forms of conflicts are counterproductive given the short delay available for project completion. In addition, since members oftentimes have never or seldom worked together previously, they may be more distrustful of each other competencies and objectives. Conflicts may further increase this phenomenon, thus limiting interactions and exchanges, bypassing richness of diversity of ideas, and ultimately decreasing performance and willingness to collaborate in future endeavors.

H4: Team conflicts are negatively related to team viability.

H5: Team conflicts are negatively related to team performance.

H6: Team conflicts are negatively related to project performance.

Openness to diversity

Above sections illustrate the necessity of efficient collaborative processes and reduced incidence of conflicts in complex collaborations, and how these are difficult to achieve when there is high diversity in team composition (Jehn et al., 2008; Stewart, 2006; Webber & Donahue, 2001). Heterogeneous teams are better equipped than homogeneous teams to address highly complex problems (Hollaender et al., 2008), so it is thus mandatory to get the most out of this diversity of perspectives and practices (Reich & Reich, 2006). Diversity and complexity should be viewed as potential resources for achieving innovative solutions to multifaceted problems rather than impediments. Hence, a primary challenge in interdisciplinary teams is how to manage complexity and heterogeneity, to make sure disciplinary boundaries do not become barriers (Hollaender et al., 2008). In order for innovation to occur, members must be able to capitalize and expand on the diversity of their ideas and take collective action (Sioukas & Sweet, 2006).

To achieve aforementioned benefits, members must be "opened" to diversity inherent to their team. Openness to diversity refers to the awareness and receptiveness to visible (i.e., age, gender, and ethnicity), value (i.e., cultural and work norms and standards guiding behaviors), and informational diversity (professional background, tenure, and work experience) (Hobman et al., 2004; Longerbeam, 2005). To respect diversity and remain vigilant in addressing in-group power dynamics, members must be sensitive to, and acknowledge differences, appreciate the diversity in various trainings, experiences, and viewpoints. They must be willing to learn about the practices, beliefs, and strengths of others (Reich & Reich, 2006).

Despite the apparent value of openness to diversity, there are few empirical studies on this construct. In addition, most of these studies assess it as a dependent variable, in relation with independent variables pertaining to diversity characteristics (e.g., gender, age, race, education, environment, tenure) in student samples taking part in factual surveys unrelated to academic or work tasks (e.g., Cabrera, Crissman, Bernal et al., 2002; Longerbeam, 2005; Pascarella, Edison, Nora et al., 1996; Wortman, 2002; Van der zee & Van Der Gang, 2007; Whitt, Edison, Pascarella et al., 2001). Only a few studies have assessed this construct's impact as an independent variable or moderator, thereby allowing limited understanding of its explicit value in relation to performance outcomes, both in academic and organizational settings. Referring to the latter studies, Hobman et al. (2003, 2004) found that perceived group openness to demographic and informational diversity has a moderating effect on the relationship between visible dissimilarity and work group involvement, and that openness to value diversity moderates the relation between value dissimilarity and conflict, in samples of employees working in ongoing service delivery. These authors suggest that teams displaying low openness to diversity are likely to fail to acknowledge and promote the diversity of human talent available, thus threatening collective understanding, and inducing confusion and interpersonal conflicts (Hobman et al., 2003). Conversely, they add that teams with high openness to diversity promote more open, fair and explorative communication between members, greater involvement of teammates in team processes, thereby a feeling that one's contribution is valued. Contribution of members is thus increased when richness of diversity within the team is effectively used (Hobman et al., 2004). Interactions between team members are also

believed to be fairer and less biased in teams that value diversity and encourage differences in perspectives (Cox, 1991; Hobman et al., 2004; Larkey, 1996).

In a recent experimental study by Homan et al. (2007), student teams manipulated to value diversity during a short task were found to make better use of informational diversity than groups valuing similarity. In a short simulation exercise among job candidates taking part in a selection procedure of a multinational hotel, Fujimoto, Hartel and Hartel (2004) found that openness to diversity is positively related to proportion of racially dissimilar others spoken to as well as to group decision effectiveness. Hence, it is likely that in autonomous teams requiring high interdependence, integrative decision-making is facilitated by openness to diversity. In turn, team members are more inclined to exert greater effort into implementing decisions in which they were actively involved (Hoegl & Parboteeah, 2006; Vroom, 1987). Openness to others' different viewpoints and suggestions allows all members to contribute and cooperatively shape and implement solutions. Conversely, "if team members feel that decisions are being imposed on them, they are less likely to contribute their own knowledge to bringing the project to successful completion," (Hoegl & Parboteeah, 2006: 70), and conflicts are more liable to emerge. In parallel, openness to informational diversity may help overcome the impact of affective conflict by either preventing its emergence or minimizing its effect by inducing more powerful intentions in seeking further information and actively communicating (Mitchell et al., 2009). Such openness is believed to be linked to epistemic curiosity, which prompts interest and motivation in gaining additional information and understanding differing and even opposing perspectives (Berlyne, 1966; Tjosvold & Sun, 2003, in Mitchell et al., 2009).

Openness to visible diversity is also believed to be capital, especially in newly formed groups, as unfamiliar teammates tend to discriminate and categorize each other by stereotypes based on overt characteristics, given scant (and oftentimes inaccurate) knowledge of each other (Fujimoto et al., 2004*)*. In light of the above findings and arguments, we posit that openness to diversity is the keystone enabling positive collaborative processes such as frequent open communication and efficient coordination aligning team members with common goals, as well as hindering counterproductive conflicts, thereby ultimately increasing performance and viability. Consequently, we postulate the following hypotheses (see also Figure 1):

H7: The relation between openness to diversity and viability will be fully mediated by collaborative processes and conflicts such that openness to diversity will lead to more efficient collaborative processes and less conflict, which in turn will lead to greater team viability.

H8: The relation between openness to diversity and team performance will be fully mediated by collaborative processes and conflicts such that openness to diversity will lead to more efficient collaborative processes and less conflict, which in turn will lead to increased team performance.

H9: The relation between openness to diversity and project performance will be fully mediated by collaborative processes and conflicts such that openness to diversity will lead to more efficient collaborative processes and less conflict, which in turn will lead to increased project performance.

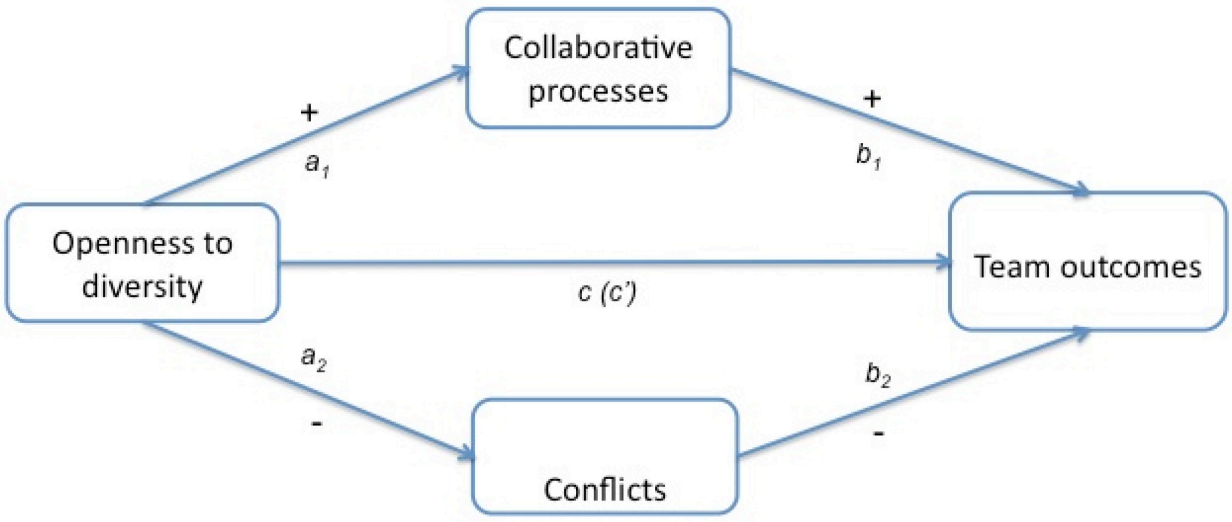

Figure 1. Path model of openness to diversity mediated by collaborative processes and conflicts, associated with team outcomes in terms of viability, team performance and project performance.

Method

Participants and procedure

Data were gathered from two integrated design real-world competitive endeavors that took place in two Canadian cities. Each followed customary procedures from the architecture and design fields where design teams bid to produce a concept that will be evaluated by the building and land owners. In these conventional procedures, multidisciplinary teams comprised of professionals (e.g., architects, urban planners, engineers), and stakeholders (e.g., city officials, members of the community) are put together following a call to develop a concept for a "green" building to be erected on urban

realty in accordance with sustainability principles (e.g., revitalization of the local economy, regeneration of the environment) (Iordanova, Forgues & Chiocchio, 2011) and community wishes. Winning concepts are awarded the construction project. Because of the relative scarcity of these teams and budget constraints, project owners used competitive processes involving graduate students, professionals and community members invited to submit concepts for two real projects.

A total of 93 participants (55% men and 45% women) with a mean age of 29 (*SD*=10.4) responded to a call placed in universities and firms with relevant curriculum (e.g., architecture, urban design, engineering, construction management, landscape architecture, communication). Project owners put together 16 similar teams of 5 to 7 members (*M*= 5.81) by distributing competencies and skills and so, as it is typical in complex collaborations and in integrated design teams, only a small percentage of team members had worked with each other in the past (i.e., 9,7% in our study). In one setting, 7 teams competed to develop a concept for revitalizing an abandoned urban site. In the other setting, 9 teams competed to elaborate a concept for a hotel to be developed from an existing heritage building. Teams with winning concepts were awarded cash prizes (2,500$ and 1,500$ respectively), media attention, and their ideas picked up by project owners and implemented by architectural and design firms. In other words, both integrated design settings had real incentives where teams had to contribute high-quality ideas and where only the best ideas and concepts would be kept and used as inputs for the next design phase. Interestingly, project owners and teams were open to take part in a study and associated measurement processes.

As with any competitive design process, teams attended a meeting hosted by project owners who presented the design problem and requirements, and complementary information (e.g., history of the area, maps, pictures, community needs assessment, adjacent urban infrastructure). Teams then proceeded in their respective workroom equipped with computers, design software and Internet connections for intensive (i.e., usually with no breaks or much sleep) work session lasting up to two days. At the end of the process, teams rejoined to formally present their concept to project owners, other teams, media, community members, and city officials.

Measurements for openness to diversity, collaborative processes, conflicts, and team performance were taken by means of a battery of valid questionnaires (to be described later) at the end of the process immediately before teams' final presentations. A panel of experts measured project performance. Panels consisted of 7-8 experts from relevant fields who were familiar with the owners' project and who had attended the owners' opening presentation. Prior to the teams' final presentations, panel members participated in a 2-hour workshop designed and delivered by authors. The workshops aimed at informing panelists of rating biases (e.g., halo, groupthink) and how to avoid them, as well as how to use the rating scale. A video of an integrated design final presentation from another context was shown. Panelists used the scale, and discussed the criteria until they and authors felt they were calibrated.

The same rating scale and procedure were used in both design settings. The scale was developed by authors following discussions with project owners who described criteria for high-quality integrated designs. It consisted of three criteria: (1) accurate analysis of the

design problem; (2) design originality and innovativeness; (3) quality and persuasiveness of presentation. During the presentations, panelists used a form with criteria definitions and space for notes to individually assess each team on all three criteria using a 9-point scale (1=very poor to 9=very good). Once all teams had presented, panelists deliberated in a separate room where they (1) each presented all of their individual ratings and associated examples of behavioral manifestations and concrete elements from the teams' presentations; (2) discussed and produced a unanimous group rating of each criteria; (3) totaled group ratings across teams; (4) reviewed steps 1 to 3 to make sure all criteria were assessed properly, and (5) rank-ordered teams based on total group ratings to determine the winning team. This process took approximately 2 hours.

Measures

Data were drawn from self-report questionnaires and rater observations. Because of the language of our participants, French adaptations of English questionnaires were used either from prior validation studies or for the purpose of this study using back translation procedures (Brislin, 1970). Questionnaire data were aggregated at the team level as suggested by Bliese (2000). Table 1 shows that all reliability estimates are high.

Table 1.
Reliability estimates of aggregated data (N=93, K=16)

	α	$r_{WG(j)}$	$r^*_{WG(j)}$	ICC (1)	ICC (2)
		***M* (*SD*) %**	***M* (*SD*) %**		
Openness to diversity	0.93	0.99 (0.01) 100	0.95 (0.03) 100	0.361	0.729
Collaboration	0.94	0.97 (0.03) 100	0.91 (0.08) 93	0.454	0.829
Conflict	0.93	0.94 (0.11) 93	0.91 (0.12) 87	0.396	0.792
Viability	0.94	0.91 (0.06) 100	0.90 (0.06) 100	0.337	0.747
Team performance	0.95	0.96 (0.04) 100	0.90 (0.06) 93	0.584	0.891

Note.
α: Chronbach's alpha at the individual level. $r_{WG(j)}$ is James et al.'s (1984) team-level index and $r^*_{WG(j)}$ is Lindell et al's (1999). % indicates the percent of indices that are above 0.70.

Openness to diversity. We measured participants' perceived openness to diversity within their teams using a 15-item questionnaire based on Hobman et al. (2003)'s scale. Items measure openness to diversity (e.g., *In my team, members were keen to learn from people from different professional disciplines*) on a 5-point agreement scale (1=strongly disagree to 5=strongly agree). In their study, Hobman et al. (2003) reported internal consistency indices from α = .82 to .94. Table 1 shows reliability estimates derived from our data compare favorably with original validation data from aforementioned authors.

Collaborative processes. This construct was measured using French items from the Collaborative work questionnaire (Chiocchio et al., in press). This 14-item self-report instrument measures collaboration (e.g., *My teammates and I shared knowledge that promoted work progress*) on a 5-point frequency scale (1=never or almost never to 5=very frequently). Authors of this instrument reported individual-level internal consistency drawn

from multiple samples to be above .91 and index of group-level reliability and rater-agreement of .83.

Conflicts. This construct was measured using an adaptation of Jehn and Mannix's (2001) 9-item self-report questionnaire tailored to reflect occurrences of key behaviors (e.g., *Our team experienced disagreements about 'who' does 'what'?*). Participants responded using a 5-point frequency scale (1=never or almost never to 5=very frequently). Authors of this instrument reported global internal consistency of $\alpha = .90$. Prior adaptation in French of this instrument also reports high internal consistency (i.e., above .80; Chiocchio, Lebel, Therriault, Boucher, et al., in press). Based on our review of studies using this instrument, which shows high positive correlations between task, process, and relational components[1], we used all 9 items into one overall measure of conflicts.

Viability. We adapted Jap's (2001) self-reported 3-item Willingness to collaborate in the future scale to assess this team-level construct (e.g., *I would welcome the possibility of additional collaboration with this team in the future*) using a 5-point agreement scale (1=strongly disagree to 5=strongly agree). This instrument's author reports an internal consistency index of $\alpha = .94$.

Team performance. We measured participants' perception of their team's performance with 5 items adapted from instruments of Hoegl, Weinkauf, & Gemuenden (2004) and of Oguntebi (2009) (e.g., *We have achieved all our team goals*) using a 5-point agreement scale (1=strongly disagree to 5=strongly agree). Hoegl et al. (2004) report an internal consistency index of $\alpha = .90$ on their instrument.

Project performance. Panelists' assessment process described above provided team-level data of the project performance, which by definition do not require aggregation. Mean panel-rated team performance was 17.50 (*SD*=4.06).

Results

Differences between design settings

Frequency distributions of demographic variables of gender, language, nationality and previous work relationship with team members did not differ across settings ($\chi^2_{(1)}$=13.96, *ns*; $\chi^2_{(1)}$= .11, *ns*; $\chi^2_{(1)}$= 2.66, *ns*; $\chi^2_{(1)}$= .10, *ns*, respectively). T-test statistics on all continuous demographic and study variables appear in Table 2. There are no differences on study variables across design conditions, except for age and project performance. As regard age, differences in mean and standard deviation indices are apparent, but there is nonetheless a large overlap in standard deviations. For team performance, means are statistically different but rather small, suggesting trivial influence. We conclude from this verification that it is adequate to proceed with pooled data across both design settings.

Table 2.
Verification of differences across settings. Setting 1 (N=46, k=7), Setting 2 (N=47, k=9)

	Setting 1 *M* (*SD*)	Setting 2 *M* (*SD*)	*T*
Age	24.48 (3.95)	32.62 (11.51)	-4.59***
Openness to diversity	4.21 (0.44)	4.43 (0.31)	-1.10
Collaborative processes	3.52 (0.67)	3.94 (0.48)	-1.40
Conflicts	1.96 (0.58)	1.45 (0.34)	2.03
Viability	4.01 (0.60)	4.57 (0.28)	-2.27
Team performance	3.55 (0.88)	4.07 (0.61)	-1.32
Project performance	15.00 (3.90)	19.40 (3.12)	-2.46*

* $p \leq .05$, ***$p \leq .005$

Determinants of viability and project performance

Hypotheses 1 to 6 can be verified using Table 3's zero-order correlations. Openness to diversity is predictive of performance and viability, and overall, results strongly support all hypotheses. However, zero-order correlations share common variance and do not allow to test for mediation effects. To better answer hypotheses 1 to 9, multivariate indirect effects must be calculated (Preacher & Hayes, 2008a, 2008b).

Table 3.

Team-level descriptive statistics and zero-order correlations (K=16)

	***M* (*SD*)**	**2**	**3**	**4**	**5**	**6**
1. Openness to diversity	4.33 (0.55)	0.81***	-0.91***	0.88***	0.71***	0.52*
2. Collaborative processes	3.75 (0.79)		-0.79***	0.87***	0.92***	0.75***
3. Conflicts	1.69 (0.73)			- 0.88***	-0.68***	-0.64***
4. Viability	4.31 (0.77)				0.82***	0.61*
5. Team performance	3.84 (0.76)					0.64**
6. Project performance	17.50 (4.06)					

*$p \leq .05$, ** $p \leq .01$, *** $p \leq .005$

Table 4 illustrates results for all measured team outcomes. Hypotheses 1, 2 and 3 postulate that efficient collaborative processes positively impact viability, team performance and project performance. Results show that after controlling for the effect of openness to diversity, collaborative processes are positively and statistically related to all outcomes (i.e., $B = .35$; $p < .05$; $B = 1.35$, $p < .005$; $B = 6.08$, $p < .01$). These hypotheses are strongly supported. Hypotheses 4, 5 and 6 postulate that conflicts negatively impact outcomes measures. Results show that after controlling for the effect of openness to diversity, conflicts are generally negatively related to outcomes, but not beyond usual alpha levels (i.e., $B = -.36$; $p = .18$; $B = .10$, $p = .79$; $B = -5.58$, $p = .10$). Hence, there is no support for these hypotheses. Interestingly, examination of both collaborative processes and conflicts on each dependent variable indicates the positive effect of collaborative processes and the mostly negative effect of conflicts.

Table 4.

Effects of mediators on the relation between openness to diversity and team outcomes (i.e. viability, team performance, project performance) (k=16)

Variable	Relation	*B*	Product of coefficients (*ab*)	
			Individual mediator effect	Combined mediators' effect
	Viability (team assessed) (adj $R^2 = 0.83$; $F_{[3,12]} = 26.31$***)			
Openness to diversity	Relation with performance (*c* path)	1.19***		
Collaborative processes	Relation with openness to diversity (*a* path)	1.26***	0.44*	0.90**
	Relation with performance (*b* path)	0.35*		
Conflicts	Relation with openness to diversity (*a* path)	-1.24**	0.45	
	Relation with performance (*b* path)	-0.36		
Openness to diversity	Relation with performance (*c*' path)	0.29		
	Team performance (team assessed) (adj $R^2 = 0.83$; $F_{[3,12]} = 25{,}86$***)			
Openness to diversity	Relation with performance (*c* path)	1.42***		
Collaborative processes	Relation with openness to diversity (*a* path)	1.26***	1.71***	1.58***
	Relation with performance (*b* path)	1.35***		
Conflicts	Relation with openness to diversity (*a* path)	-1.24**	-0.12	
	Relation with performance (*b* path)	0.10		
Openness to diversity	Relation with performance (*c*' path)	-0.16		
	Project performance (jury rated) (adj $R^2 = 0.60$; $F_{[3,12]} = 8{,}61$**)			

Openness to diversity	Relation with performance (*c* path)	5.59*		
Collaborative processes	Relation with openness to diversity (*a* path)	1.26***	7.69***	14.63***
	Relation with performance (*b* path)	6.08**		
Conflicts	Relation with openness to diversity (*a* path)	-1.24**	6.93*	
	Relation with performance (*b* path)	-5.58		
Openness to diversity	Relation with performance (*c*' path)	-9.04		

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .005$.

Hypotheses 7, 8 and 9 postulate that both collaborative processes and conflicts fully mediate the relationship between openness to diversity and viability, team performance, and project performance. These hypotheses are confirmed: there is full mediation for viability (R^2=.83, $p \leq .005$; combined effect = .90, $p \leq .01$), team performance (R^2=.83, $p \leq .005$; combined effect = 1.58, $p \leq .005$), and project performance (R^2=.60, $p \leq .005$; combined effect = 14.63, $p \leq .005$). Further examination of Table 4 reveals that collaborative processes capture most of the mediation for viability and team performance, while both collaborative processes and conflicts equally and fully mediate the relationship between openness to diversity and project performance (see individual mediator effect column).

Discussion

Summary of findings

The purpose of our study is to examine the extent to which openness to diversity predicts important project team outcomes. Our results support previous studies in showing the importance of openness to diversity in promoting work group involvement and reducing conflicts (Hobman et al., 2003, 2004; Fujimoto et al., 2004), but extend current knowledge by demonstrating the critical and intricate mediating roles of collaborative processes and conflicts through which openness to diversity exerts its effect in predicting viability, team performance and project performance. Hence, while past research stressed the importance of collaborative processes in promoting effectiveness in complex collaborations (Cummings & Kiesler, 2005; Dedekorkut, 2004; Osman, 2004; Peter & Fletcher, 2004), as

well as the detrimental effect of conflicts on the latter outcome (Akkerman et al., 2006; Bagshaw et al., 2007; Jehn & Benderski, 2003), we are to our knowledge the first to show that collaborative processes and conflicts work as intricate catalysts in how openness to diversity leads to viability, and team and project performance.

More specifically, multivariate analyses for viability, team and project performance show full mediation effects. The positive total effect of openness to diversity in predicting team outcomes disappears when collaborative processes and conflicts are taken into consideration. Our results show that openness to diversity positively predicts collaborative processes and negatively predicts conflicts. Specific indirect effect indices for project performance, as assessed by jury members, indicate that both collaborative processes and conflicts mediate to similar extent the relationship between openness to diversity and performance. On the other hand, indices for viability and team performance, as self-reported by team members, show that only collaborative processes is positively related to these outcomes while the negative impact of conflicts is not significant once collaborative processes are considered. This suggests that conflicts do not contribute to the indirect effect above and beyond collaborative processes. In sum, overall results show that collaborative processes and conflicts both play a role in predicting team outcomes, but that additionally, collaborative processes seem a stronger overall predictor of outcomes than conflicts.

Theoretical and practical implications

Integrated design projects are a good example of complex collaborations. Complex collaborations are characterized by diversity in national, organizational and/or disciplinary

cultures of oftentimes unfamiliar collaborators working together on complex, ambiguous, non-routine tasks involving uncertain outcomes. Given this context and rather than investigating openness to diversity as an outcome as it is the case in most empirical studies, we shed new light on openness to diversity's role as an important predictor of team outcomes. Our findings come at a time when diversity is seen as necessary in work groups, but often recognized as an impediment to positive group dynamics and performance outcomes.

From a theoretical point of view, our results suggest several critical insights on openness to diversity. First, our results show that openness to diversity in and of its own is insufficient to predict viability, team performance and project performance. However, openness to diversity plays an important role in predicting collaborative processes and conflicts. Openness to diversity is important to team outcomes because it triggers collaborative processes and hinders conflicts. This is consistent with theories that state that personal dispositions affect team processes and team emergent states (Kozlowski, Gully, Nason, & Smith, 1999). Furthermore, it supports and extends Burke et al.'s (2006) model of adaptive teams. These authors state that team adaptation unfolds over time and that openness to experience impacts the adaptive cycle, specifically its plan execution phase, which is comprised of mutual monitoring, communication, back-up behavior, coordination, leadership, and team learning. So, on the one hand, our results show that one trait-like component of openness to experience (i.e., openness to diversity) is directly related to many components of plan execution. On the second hand, because our results pertain to intense but short performance episodes, the impact of openness to diversity on elements of the plan

execution phase is established rather rapidly.

Second, our results provide further evidence of the negative effect of conflicts on team performance, addressing recurrent disagreements among researchers on the impact of conflicts on such outcome. These findings bring additional weight to our initial argument that conflicts are counterproductive in complex collaboration contexts involving short deadlines. Self-managed teams, such as integrated design teams, must rely on themselves to resolve conflicts and problems (Cohen & Ledford, 1994; Kirkman & Rosen, 1999; Spreitzer, Kizilos, & Nason, 1997). While conflict management capabilities are important in all types of teams, these capabilities are critical for workers involved self-managing teams (Alper, Tjosvold, & Zorn, 2000). Alper et al. (2000) underscore that issues to be resolved may be numerous: personality-related, work roles and habits, work procedures and methods, work quality, scheduling. Previous research suggests that teams who use more collaborative communication and less contentious communication when expressing disagreements are less inclined to experience the negative effects of conflicts (Lovelace, Shapiro, & Weingart, 2001). De Dreu and Weingart (2003) further posit that negative effects of conflicts on performance may be reduced, perhaps reversed, when teams evolve in open environments that are characterized by collaboration rather than contention. Our results suggest that the positive effect of collaborative processes surpasses the negative effect of conflicts or exerts a protective effect against them even in the context of important time constraints and thus in the absence of "time outs" allowing to actively engage in conflict resolution. This implies that smooth collaborative processes involving quality task-related communication, coordination and synchronicity – as measured in this study – may

be sufficient to overcome conflicts' effects. Hence, while our results echo De Dreu's (2007) contention that cooperative goal and outcome interdependence promotes constructive dispute resolution, especially when team members display high task reflexivity (e.g., review and discussion of objectives, methods and processes), our results also answer De Dreu and Weingart's (2003) suggestion of a potential reversal of effects of collaboration over conflict.

Another important theoretical implication of this study pertains to the inclusion of different dependent variables. Indeed, task performance is regularly assessed as a dependent variable in organizational psychology and management literature as it is a core criterion upon which are based expectations, namely in terms of quality, innovation and effectiveness. On the other hand, team viability, or willingness of collaborators to work together again in the future, is less investigated, especially in teams working on short-term projects. However, such outcome is important. High team viability in these teams, although it is not necessarily the practice at this time, suggests a potential for team members to work together on similar projects in the future, building on new collective knowledge generated and acquired from their working sessions together to potentially reach even higher levels of quality and innovation subsequently. Further, Mankin & Cohen argue that the fact of having worked together before in complex collaboration context "may develop collaboration skills and possibly even help build a culture of relationships that can lay the groundwork for future collaborations across multiple boundaries." (2004b: 11).

Our study also points to noteworthy practical implications. For example, it is important to stress that students in architecture, engineering and landscaping are trained

within their silos of expertise with little exposure to boundary-spanning activities and interdisciplinary collaborative processes (Chiocchio & Forgues, 2008). This is not unlike other programs such as in psychology, for instance (Dunn, McCarthy, Baker, Halonen, & Hill, 2007). Given students of all fields will be increasingly required to work collaboratively across boundaries, universities should offer such training in their curriculum through real-world projects, with an emphasis on interdisciplinary teamwork and team-building, communication skills, open-ended problem solving and hands-on, real world application of what they are learning in the theory (Klukken, Parsons, & Columbus, 1997). Our results show that team members that – presumably – were not trained in interdisciplinary teamwork and skills development nonetheless engaged in efficient collaborative processes sufficiently to counter the negative impact of conflicts. We believe and hypothesize that future generations of professionals trained in boundary-spanning teamwork will display similar but stronger effects. In organizational settings, our study results also provide pertinent and accessible practical paths. For instance, research by Klein et al. (2009) indicate that team building interventions, through formal and informal components of goal setting, interpersonal relations, problem solving, and role clarification, are most effective for achieving positive team process outcomes in terms of communication and coordination. Adding dimensions related to awareness, respect and value of diversity to these interventions would more strongly foster communication and coordination to exert an even more potent impact on team outcomes.

Limits

Team characteristics, sample size, and multicollinearity are limits that should not be overlooked. The design setting was realistic, but teams in our sample are comprised of both university students and seasoned professionals. Team size was adequate, but our number of teams was rather small. Also, our results show high correlations among mediators, which generally lessen specific indirect effects and can lead the researcher to conclude that a proposed variable does not act as a mediator when it does or to conclude that it does when it does not (Preacher & Hayes, 2008a). However, our measures' validity and reliability indices are very high, suggesting that attenuation due to collinearity may be attributable to methodological bias (i.e., self-reported questionnaires in the case of the prediction of viability and team performance). Additionally, as previously explained, we found differences between settings on variables of age and project performance, but we believe these were minor and did not affect validity of results. In order to ascertain that differences in project performance were indeed inconsequential, we performed additional statistical analyses that compared all beta coefficients across settings (MacKinnon, 2008). All tests of homogenous action theory (i.e., differences between *a* paths) reveal no significant differences between both settings, nor do the tests of homogenous conceptual theory (i.e., differences between *b* paths). In addition, tests of equality of total effects (i.e., differences between *c* paths), of equality of direct effects (i.e., *c'* paths), of equality of mediated effects (i.e., products of indirect effects) as well as of equality of all mediated effects also indicate no statistical differences between settings.

Future directions

In addition to a call to academics to conduct more research on complex collaborations, we suggest three avenues for future research. First, our study could be replicated, but rather than using a regular multiple-mediator design, it could use a multi-step multiple mediator model (see Hayes et al., 2011), which enables to assess if mediators causally affect other mediators. Such procedure could thus namely address the potential preventive effect of collaborative processes on conflicts, as suggested above. Second, future studies with enough power to account for additional variables and after addressing potential problems with non-orthogonality, should also extend our findings to subdimensions of openness to diversity (i.e., visible, value, informational diversity), collaborative processes (i.e., communication, coordination, synchronicity) and conflicts (i.e., task, process, and relational). Relations between subconstructs may not fully align on the relationships we found with our global constructs.

Conclusion

This study is an important contribution to the scarce literature on complex collaborations, and – to our knowledge – the first of its kind on openness to diversity in integrated design teams. Our findings underscore the importance of integrative models combining multiple factors to understand how facilitating and impeding factors work concurrently to predict taskwork and teamwork outcomes. Assessing the intricate mechanisms that make complex collaborations successful is paramount given increased use

of heterogeneous teams, faster pace of work and time pressures, and growing reliance on technology prevalent in organizations nowadays (Hinsz et al., 2009).

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Footnote

1. Limitations in scale properties and critiques as to a clear conceptual distinction between task, process, and relational conflicts have recently been made (Bendersky, Behfar, Weingart et al, 2010). It has been known for a number of years that conflict types are interrelated (Jehn and Catman, 2000) and many studies report high correlations between sub-constructs. For example, Simons and Peterson (2000) report a .57 correlation between task and relational conflict and Jehn and Mannix (2001) report positive correlations ranging from .48 to .63 between conflict types. More recently, Jehn, Rispens, and Thatcher (2010) report a .60 correlation between task and relational conflict.

Conclusion

L'objectif principal et global de cette thèse vise à accroitre les connaissances sur les collaborations complexes. Cet objectif global comprend plusieurs sous-objectifs distincts ayant fait l'objet des deux articles de cette thèse.

Le premier article visait d'abord à dégager une définition claire et circonscrite des collaborations complexes. À partir des critères émergeant de cette définition, une revue de documentation exhaustive sur les facteurs favorisant le succès et l'efficience des collaborations complexes a été effectuée, englobant à la fois les contextes de collaboration international, interorganisationnel et interdisciplinaire. Enfin, un modèle théorique systémique et multi-niveaux illustrant les relations entre ces facteurs et divers extrants a été élaboré afin de favoriser une meilleure compréhension du phénomène intégral, ainsi que dégager de nouvelles pistes de recherche.

Le deuxième article avait comme objectif de vérifier empiriquement l'impact de certains facteurs particulièrement influents en contexte de collaborations complexes sur diverses mesures d'efficacité, auprès d'échantillons composés d'équipes interdisciplinaires et interorganisationnelles. Plus précisément, l'étude évalue l'effet modérateur des processus collaboratifs efficaces et des conflits sur la relation entre l'ouverture à la diversité et 1) la viabilité d'équipe, 2) la performance d'équipe et 3) la performance de projet.

Bilan des résultats

Premier article

Le premier article présente une définition des collaborations complexes élaborée en fonction des principaux écrits sur le sujet publiés au cours des dernières années. Un examen minutieux de ces écrits révèle que ce construit réfère d'abord et avant tout à des démarches collaboratives en contextes international, interorganisationnel ou interdisciplinaire, lesquelles sont habituellement complexifiées par des éléments d'ambiguïté, de nouveauté et d'incertitude liés à la tâche à accomplir et aux résultats qui en découleront. Globalement, les collaborations complexes sont une forme de collaboration caractérisée par une certaine diversité au niveau des cultures nationales, organisationnelles ou disciplinaires de collaborateurs, souvent non familiers, qui travaillent ensemble à des tâches complexes, ambigües, et non routinières menant à des résultats incertains.

Cette définition a ensuite servi d'assise pour établir les critères d'inclusion permettant d'effectuer une revue de documentation exhaustive sur les facteurs favorisant le succès et l'efficience des collaborations complexes. La revue de documentation est fondée sur des études empiriques de types qualitatif et quantitatif. Elle a permis d'identifier et de synthétiser 14 facteurs rapportés à travers des contextes de collaboration international, interorganisationnel et interdisciplinaire, et d'expliciter leurs manifestations et particularités dans chacun de ces contextes.

En se fondant sur les travaux de Ilgen, Hollenbeck, Johnson, & Jundt (2005), les 14 facteurs identifiés ont été transposés dans le modèle conceptuel de type fonctionnel IMEI (intrants-médiateurs-extrants-intrants), et présentés à divers niveaux, soit individuels, groupaux et organisationnels. Un tel modèle offre un canevas théorique riche et solide permettant aux chercheurs et praticiens de clarifier un nombre croissant de relations dynamiques et causales complexes.

La revue de documentation exhaustive intégrant les contextes de collaboration internationaux, interorganisationnels et interdisciplinaires, ainsi que le modèle de l'efficacité des collaborations complexes visaient à palier certaines lacunes majeures notées dans les études antérieures. Notamment, celles-ci ont focalisé de façon isolée sur chacun des contextes séparément, sans chercher à les intégrer et à examiner les éléments distinctifs et communs entre eux, limitant ainsi la compréhension du phénomène et l'identification de pistes de recherche et d'interventions ciblées. En effet, il est fréquent que les contextes de collaboration susmentionnés s'entrecroisent, et il importe donc de voir au-delà des silos traditionnels étudiés. En lien avec cette remarque, un des faits saillants émergeant de cette revue de documentation est que la presque totalité des facteurs identifiés (soit 12 sur 14) sont rapportés dans chacun des trois contextes. Ce constat illustre dans un premier temps que les collaborations en divers contextes interculturels partagent non seulement des défis semblables, mais également des pistes de solution similaires, que ces différences culturelles soient au niveau national, organisationnel ou disciplinaire. Dans un deuxième temps, cette observation suggère par le fait même que puisque ces facteurs sont véritablement influents peu importe le contexte, ils pourraient potentiellement être transposés dans une panoplie de

situations de travail, où la diversité compositionnelle des collaborateurs ainsi que la complexité et l'ambigüité des tâches et des résultats sont saillants et constituent des défis importants.

Des constats découlent également de la fréquence à laquelle certains facteurs sont rapportés. En effet, cette recherche démontre que les médiateurs liés tant aux processus de structure (c.-à-d., l'établissement et la compréhension d'objectifs clairs et communs) qu'aux processus collaboratifs (c.-à-d., communication et coordination) sont les facteurs d'efficacité les plus fréquemment mentionnés. Ceux-ci permettent vraisemblablement de réduire une part importante de l'ambigüité et de l'incertitude liées aux tâches et aux projets non routiniers ainsi qu'à la diversité culturelle inhérente aux idéologies et méthodologies, par exemple. Des processus structurants clairs, transmis par une communication efficiente et efficace, permettent de réduire l'ambigüité ainsi que de faciliter le développement d'une compréhension, d'une signification et d'une identité groupale communes. En effet, la communication joue un rôle important dans tout contexte de travail collaboratif, mais elle s'avère particulièrement cruciale lorsque la diversité au niveau des jargons, des méthodes et des idéologies est importante entre collaborateurs. Dans une telle situation, elle permet notamment l'échange d'information adéquat, la clarification des concepts et des attentes, ainsi que la coordination explicite par l'échange d'information concrète permettant de savoir quels individus doivent effectuer quelles tâches et à quel moment.

Un autre fait saillant de la revue de documentation est le très peu d'études quantitatives ayant été menées en contexte international, mais aussi en contexte interorganisationnel. En effet, bien qu'il existe un certain nombre d'études qualitatives

inhérentes à ces contextes, les données quantitatives sont beaucoup plus rares. Il semble donc y avoir un besoin criant à ce niveau. La difficulté liée au recrutement de participants à travers les nations et les organisations (c.-à-d., impliquant des frontières de distance) explique probablement le peu d'études réalisées dans ces contextes.

Deuxième article

Le deuxième article consiste en une étude empirique menée auprès de 16 équipes interdisciplinaires, interorganisationnelles et interinstitutionnelles prenant part à des sessions de travail intenses visant la production de concepts innovateurs en design intégré. Cette étude a permis démontrer que certains facteurs, dont les effets sur la viabilité et la performance des équipes ont été rapportés isolément dans des études précédentes, sont à la fois conjointement et uniquement associés à ces extrants lorsqu'analysés simultanément. De façon plus précise, les analyses de médiation multiple (Preachers & Hayes, 2008) réalisées dans cette étude révèlent un effet de médiation complet par les variables de processus collaboratifs (communication, coordination et synchronisation) et de conflits globaux sur la relation entre l'ouverture à la diversité et la viabilité en contexte de collaboration complexe. Des résultats similaires sont obtenus pour la relation entre l'ouverture à la diversité et la performance d'équipe et la relation entre l'ouverture à la diversité et la performance de projet (par le biais d'évaluations de sources interne et externe, respectivement). Globalement, l'article conclut qu'une ouverture à la diversité accrue influence positivement la performance et la viabilité des équipes, en favorisant l'émergence de processus collaboratifs efficients et en inhibant l'émergence de conflits.

Bref, plus les membres d'une équipe font preuve d'ouverture à la diversité, plus les processus collaboratifs inhérents à leurs interactions dans la tâche sont efficients, et moins il y a d'incidences de conflits et de tensions dans l'équipe, ce qui a pour conséquence d'accroître la performance d'équipe et la performance de projet, ainsi que l'intention des membres de l'équipe à vouloir collaborer à nouveau ensemble dans de futurs projets. Par ailleurs, ces effets de médiation complets expliquent entre 60% et 83% de la variance dans chacun des modèles étudiés, ce qui indique donc l'importance des variables retenues dans l'étude.

En examinant les variables indépendantes et modératrices isolément, plusieurs constats intéressants se dégagent. En premier lieu, tel qu'anticipé, l'ouverture à la diversité est statistiquement et positivement liée aux processus collaboratifs, et statistiquement et négativement liée aux conflits, à la fois en analyses corrélationnelles habituelles et en analyses de médiation multiples. Les hypothèses relatives aux liens spécifiques des médiateurs avec chacun des extrants mesurés (c.-à-d., la viabilité, la performance d'équipe et la performance de projet) sont toutefois partiellement confirmées. Les données corrélationnelles indiquent des liens statistiquement significatifs et positifs élevés entre les processus collaboratifs et les extrants ainsi que des relations significatives et négatives élevées entre les conflits et ces mêmes extrants. Toutefois, dans un souci d'aborder le problème de variance commune inhérent aux corrélations bivariées simples (corrélations de Pearson), les effets indirects multivariés de ces variables médiatrices ont été examinés, et révèlent des résultats mitigés. Ces résultats indiquent qu'en contrôlant pour l'effet de l'ouverture à la diversité, les processus collaboratifs sont positivement et statistiquement

liés à tous les extrants mesurés. Par contre, en contrôlant pour l'effet de l'ouverture à la diversité, les conflits globaux sont majoritairement liés négativement aux extrants (sauf pour la performance d'équipe auto-rapportée), mais les indices se situent sous les seuils de signification alpha habituellement reconnus.

De plus, les indices statistiques quant à l'effet indirect spécifique de chacun des médiateurs sur la performance de projet (évaluée par les membres du jury) indiquent que les processus collaboratifs et les conflits exercent tous deux un effet médiateur d'ampleur similaire sur la relation entre l'ouverture à la diversité et la performance de projet. Toutefois, les mêmes indices pour la viabilité et la performance d'équipe (auto-évaluées par les membres de l'équipe) montrent que seuls les processus collaboratifs présentent des liens positifs et significatifs avec ces extrants, l'impact négatif des conflits n'étant pas significatif lorsque l'ouverture à la diversité et les processus sont pris en compte. Un tel résultat suggère donc que les conflits ne contribueraient pas à l'effet indirect au-delà des processus collaboratifs. Bref, l'ensemble des données indiquent que les processus collaboratifs et les conflits jouent tous deux un rôle dans la prédiction des extrants mesurés, mais aussi que les processus collaboratifs semblent constituer un meilleur facteur prédictif global que les conflits.

De tels résultats soulèvent une réflexion à l'effet que le type de mesure utilisé pourrait être en cause quant à l'effet mitigé des conflits. En effet, lorsque toutes les mesures sont auto-révélées, les conflits ne jouent pas un rôle important dans les relations de médiation. Lorsque la variable dépendante est externe aux membres des équipes, l'effet des conflits se manifeste. Il est donc possible que l'usage concomitant des mesures de conflits,

de viabilité et de performance d'équipe amène la mesure des conflits à perdre sa valeur prédictive. Dans un tel cas, cela soulignerait une limite conceptuelle de cet instrument sur laquelle de futures recherches devraient se pencher. Étant donné la clarté du modèle explicatif de la performance de projet, il est toutefois pertinent de conclure que la mesure des conflits n'est pas sans fondements.

Apports singuliers et forces de la thèse

Cette thèse doctorale apporte plusieurs contributions originales et significatives à l'avancement des connaissances en matière de collaborations complexes. Ces contributions sont présentées en fonction des deux articles qui ont fait l'objet de la thèse.

Premier article

D'abord, en ce qui a trait au premier article, une définition des collaborations complexes fondée sur les écrits majeurs et récents sur le sujet a été élaborée pour la première fois. Cette démarche a permis de clarifier le construit et de délimiter des critères explicites permettant de mieux l'identifier et le comprendre. L'article présente également la première revue de documentation réalisée à ce jour sur les facteurs favorisant le succès et l'efficience des collaborations complexes, englobant les trois contextes principaux qui les caractérisent. Les études antérieures ont majoritairement porté sur les défis et les obstacles inhérents à cette forme de collaboration, ce qui limitait fortement la compréhension des conditions favorables pour mener à bien celle-ci. De plus, chacun des facteurs est présenté

en lien avec les particularités inhérentes au contexte rapporté et plusieurs extrants associés à divers niveaux et critères d'efficience et de rendement (p.ex., satisfaction, performance, viabilité, apprentissages, profitabilité, innovation, etc.).

Troisièmement, la thèse propose le premier modèle conceptuel présentant les facteurs favorisant le succès et l'efficacité des collaborations complexes, permettant une compréhension accrue des dynamiques interactives entre ces facteurs et les divers extrants susmentionnés. De plus, ce modèle offre plusieurs hypothèses pouvant être vérifiées empiriquement dans de futures recherches.

Globalement, il importe de souligner que la revue de documentation et le modèle de l'efficacité des collaborations complexes permettent de répondre aux préoccupations de plusieurs chercheurs s'étant récemment penchés sur des sujets en lien avec ce construit. En premier lieu, cette thèse doctorale vise à identifier les facteurs et conditions qui font en sorte que la diversité engendre des résultats positifs, au lieu de poursuivre le débat quant à savoir si la diversité compositionnelle des équipes est utile ou non, répondant ainsi à l'appel d'auteurs tels Jackson, Joshi et Erhardt (2003), Van de Ven Rogers, Bechara et Sun (2008), ainsi que Webber et Donahue (2001). En deuxième lieu, en suivant les recommandations de Gelfand, Erez & Aycan (2007), la présente recherche évite de se pencher sur une seule dimension culturelle en intégrant les dimensions nationale, organisationnelle et disciplinaire simultanément, sortant ainsi des silos habituels en recherche dans ce domaine. Dans un même sens, cette thèse rejoint les préoccupations de Shore et al. (2009), lesquels soulignent qu'il est impératif que les chercheurs abandonnent les anciens paradigmes et les modes de pensée limitatifs afin de développer des théories pratiques et intégratives sur la diversité qui

aideront les leaders organisationnels à développer des systèmes dans lesquels une diversité de travailleurs, de même que l'organisation, peuvent s'épanouir.

Deuxième article

À ma connaissance, aucune étude à ce jour n'a investigué l'influence de l'ouverture à la diversité sur la viabilité des équipes, la performance des équipes et la performance de projet de façon directe et isolée, et encore moins en fonction de l'effet médiateur de dynamiques groupales reconnues comme critiques en contextes de collaboration complexes, soit les processus collaboratifs et les conflits. Cette étude est également la première à évaluer l'impact de l'ouverture à la diversité chez des équipes de design intégré, celles-ci étant par ailleurs très peu étudiées en général.

À cet effet, les résultats de cette thèse doctorale corroborent les quelques données existantes relatives au rôle clé qu'exerce l'ouverture à la diversité, mais amène un apport supplémentaire en abordant spécifiquement le contexte de collaborations complexes, où la diversité est naturellement saillante et généralement considérée comme un obstacle aux dynamiques groupales positives et à la performance. Par ailleurs, au lieu d'étudier ce construit en tant que variable dépendante comme ce fut le cas dans la majorité des études empiriques sur le sujet, cette thèse apporte un éclairage nouveau en démontrant que l'ouverture à la diversité exerce son effet bénéfique sur la performance de projet par le biais conjoint et similaire des processus collaboratifs et des conflits, et sur la viabilité et la performance d'équipe principalement par l'entremise des processus collaboratifs.

Ces résultats soulignent également la valeur d'un modèle intégratif qui permet de

combiner plusieurs facteurs simultanément, et favorise ainsi une meilleure compréhension de l'effet concurrentiel de médiateurs importants dans la prédiction des extrants retenus. Les analyses de médiation multiples offrent un modèle plus réaliste et moins biaisé que les analyses de médiation simple, notamment en permettant à la fois de tester l'effet de plusieurs médiateurs simultanément et de distinguer l'effet de chacun isolément (Hayes, Preacher, & Myers, 2011).

Cette étude présente également plusieurs forces importantes au chapitre du devis méthodologique. En effet, l'échantillon est constitué d'équipes de travail naturelles accomplissant des tâches réelles ayant un impact concret, en milieu de travail réel mais contrôlé. Les études sur le terrain sont essentielles pour capter un portrait véritable des mécanismes opérant dans un contexte précis (Johns, 2006), et permettent d'identifier des pistes à la fois pratiques et théoriques. Le devis de la présente recherche doctorale combine plusieurs avantages et qualités des études de laboratoire à celles des études sur le terrain. En particulier, il permet de contrôler les facteurs identifiés comme ayant un impact majeur dans les études traitant de la diversité des équipes de travail et leur performance, soit le type et la taille d'équipe, le niveau d'interdépendance et de complexité des tâches et la durée des interactions entre membres d'équipe (Horwitz, 2005). Or, ces facteurs sont uniformes à travers l'échantillon sondé, de par le format des projets de conception intégré dont fait l'objet la recherche. Tel que souligné précédemment, il existe peu d'études empiriques quantitatives sur les facteurs favorisant l'efficacité des collaborations complexes, et surtout sur l'ouverture à la diversité, et aucune étude à ma connaissance n'a sciemment contrôlé l'ensemble de ces facteurs cruciaux simultanément. Il est important également de souligner

que le taux de participation à cette étude est de 97%. Un pourcentage si élevé est rare en recherche et apporte donc un poids supplémentaire aux résultats obtenus. Ce taux de réponses a été favorisé par le fait que l'administration des questionnaires a été effectuée sur les lieux de travail alors que tous les participants étaient disponibles, soit immédiatement après la fin des travaux et avant la présentation de ceux-ci devant auditoire.

Une autre force importante de l'étude réside dans l'inclusion de plusieurs variables dépendantes. L'efficacité des équipes est généralement conçue comme comportant plusieurs facettes dont les critères sont à la fois internes (p.ex. satisfaction, viabilité) et externes (p.ex. productivité, performance) (Hackman, 1987). Il est donc important d'évaluer les deux critères. En ce qui a trait au critère externe, la mesure de performance de projet, évaluée par membres de jury, offre un avantage majeur du fait qu'elle est parfaitement adaptée à réalité des équipes et des tâches inhérentes aux projets de conception intégrée. Par ailleurs, le processus d'évaluation en soi est très rigoureux, comportant cinq étapes définies et minutieuses. De plus, une formation préalable sur le processus d'évaluation, l'utilisation de la grille d'évaluation et la sensibilisation aux biais de mesure a été dispensée aux membres du jury afin d'optimiser la validité et la fiabilité de la démarche. En ce qui concerne le critère interne, il comporte deux facettes. La première est l'évaluation de l'équipe quant à sa perception de performance et d'efficience relativement au travail accompli, et permet ainsi de saisir une auto-évaluation quant aux objectifs rencontrés, à la gestion du temps et au respect des échéanciers. Toutefois, bien qu'une équipe puisse s'avérer performante sur les points susmentionnés (à la fois ceux cités par l'évaluation externe et l'évaluation interne), les membres qui la composent peuvent être

très réticents à vouloir travailler ensemble à nouveau, étant donné la présence de conflits ou autres dynamiques intra-groupales négatives, par exemple (Kline, 1999; Sundstrom, De Meuse, & Futrell, 1990). Des études récentes ont révélé que la durée et les antécédents de la relation collaborative sont des facteurs importants en contexte de collaborations complexes, puisque la confiance, l'engagement, les normes communes et la réciprocité se développent avec le temps et le nombre d'interactions (Kessel, Rosenfield, & Anderson, 2003; Osman, 2004). De plus, les apprentissages collectifs qui découlent d'une collaboration sont précieux pour les projets subséquents du même genre. Les équipes de conception intégrée sont rares et peuvent fortement bénéficier des apprentissages tirés de leur expérience de travail commune sur un projet donné. Par ailleurs, en situation de projet de conception intégré s'étalant sur de plus longues périodes, le départ de membres de l'équipe peut engendrer divers problèmes comme retarder le projet et reléguer l'équipe à un stage antérieur de développement (Tannenbaum, Mathieu, Salas, & Cohen, sous presse).

Le niveau d'analyse des variables étudiées dans cette thèse doctorale constitue une autre force. En effet, tous les construits ont été analysés au niveau de l'équipe, plutôt qu'au niveau individuel, évitant ainsi les erreurs commises dans plusieurs études antérieures. Un tel choix entraine de lourdes conséquences par rapport à la puissance statistique, mais il permet d'étudier adéquatement des construits liés aux phénomènes groupaux. En effet, il aurait été inapproprié d'évaluer des construits tels les processus collaboratifs et les conflits entre membres d'une équipe ainsi que la performance liée au projet global en effectuant des analyses individuelles (à moins de ne référer qu'aux perceptions individuelles des phénomènes groupaux).

Enfin, une autre contribution notable de cette thèse doctorale se rapporte à la validation de certains instruments de mesure. En effet, la présente recherche offre une validation préliminaire des instruments en français pour les construits d'ouverture à la diversité, de viabilité et de performance d'équipe. Les coefficients de cohérence interne obtenus sont élevés, ainsi que les indices d'agrégation des données. Des études supplémentaires au sujet de ces construits sont donc possibles, tout en gardant à l'esprit de poursuivre les efforts de validation.

Limites de la thèse

Bien que cette recherche doctorale génère plusieurs contributions significatives sur les plans théoriques et pratiques, elle présente néanmoins certaines limites. En premier lieu, il convient de souligner les limites associées à la petite taille de l'échantillon sondé, lequel comprend 16 équipes. Il est en effet difficile de généraliser les conclusions tirées des résultats obtenus à l'ensemble des équipes en conception intégrée, bien que celles-ci soient toutefois rares en milieu organisationnel. Par ailleurs, étant donné la taille réduite de l'échantillon, seul un petit nombre de variables inhérentes au modèle global de l'efficacité des collaborations complexes a pu être inclus dans l'étude empirique, étant donné les contraintes liées à la puissance statistique requise.

Par ailleurs, l'étude a eu recours à une majorité de mesures auto-rapportées. Il est donc possible d'envisager qu'un biais de variance commune ainsi qu'un biais lié à l'effet de clémence engendrés par la méthode aient pu amener une part d'erreur de mesure dans les

données. Toutefois, la collaboration, les conflits et surtout l'intention de vouloir collaborer à nouveau avec les membres de son équipe réfèrent à une expérience et une impression subjectives. Quant à la mesure de performance d'équipe auto-rapportée, il est important de souligner que j'ai pris soin d'administrer le questionnaire avant la présentation devant jury, citoyens et équipes compétitrices, afin d'éviter que les participants ne puissent se comparer aux autres équipes et ne connaissent le verdict du jury quant à l'équipe gagnante au concours. Par ailleurs, je me suis également assurée que les participants soient éloignés physiquement les uns des autres pour répondre au questionnaire, principalement pour éviter qu'ils ne soient réticents à rapporter la présence de conflits ou le manque de collaboration et d'ouverture au sein des équipes où ils ont travaillé.

Il convient également de souligner la possibilité de biais liés au phénomène de multicollinéarité. En effet, les résultats des analyses corrélationnelles indiquent des relations élevées entre médiateurs, ce qui peut ainsi laisser croire à tord qu'une variable n'exerce pas d'effet de médiation alors que c'est le cas, ou encore l'inverse (Preacher & Hayes, 2008). Tel qu'indiqué précédemment, les mesures de validité et de fiabilité étant très élevées, l'atténuation de l'effet des conflits pourrait être attribuable à un biais méthodologique de mesures auto-rapportées de viabilité et de performance d'équipe.

Enfin, certaines différences se rapportant à l'âge des participants et à la performance de projet ont été relevées entre les deux échantillons qui ont été combinés dans l'étude. Afin de vérifier si les différences notées quant à la performance de projet n'engendraient pas de conséquences indésirables sur l'interprétation des données, des analyses statistiques supplémentaires, permettant de comparer tous les coefficients beta selon les échantillons,

ont été effectuées selon les recommandations MacKinnon (2008). Toutes les analyses ont révélé des résultats non significatifs entre échantillons (Appendice 3), confirmant que ces différences n'affectent pas la validité des conclusions de l'étude. En parallèle, il est pertinent de soulever que l'échantillon était composé d'étudiants et de professionnels, ce qui pourrait expliquer certaines différences d'âge importantes. Il est néanmoins possible que cette différence puisse constituer un apport plutôt qu'une limite. En effet, en milieu organisationnel, il existe habituellement une diversification d'âges et d'expériences entre travailleurs. Par ailleurs, cette diversité supplémentaire dans l'échantillon sondé confère une pertinence accrue au questionnaire d'ouverture à la diversité utilisé, lequel mesure cette dimension.

Pistes de recherche futures

Plusieurs pistes de recherche futures permettant de poursuivre l'avancement des connaissances sur les collaborations complexes se dégagent de cette thèse doctorale. En premier lieu, des études subséquentes avec de plus grands échantillons conférant une puissance statistique accrue, pourraient reproduire la présente recherche en investiguant distinctement les sous-dimensions des construits de l'ouverture à la diversité, des processus collaboratifs, et des conflits. Une telle démarche permettrait d'évaluer si certaines sous-dimensions exercent une influence plus grande que d'autres sur les médiateurs ainsi que les divers extrants mesurés.

Par ailleurs, de futures recherches pourraient reproduire la présente recherche, mais intégrer cette fois d'autres extrants du modèle global de l'efficacité des collaborations complexes. Il serait fort opportun, par exemple, d'évaluer l'influence des variables indépendantes et modératrices précitées sur les apprentissages individuels et groupaux. Les résultats seraient probablement différents des résultats habituels liés à performance ou la satisfaction. En effet, on peut d'emblée s'attendre à ce que l'ouverture à la diversité et les processus collaboratifs efficients soient positivement liés à la richesse et la quantité des apprentissages. Toutefois, contrairement aux liens usuels entretenus avec la performance, les conflits pourraient engendrer des impacts positifs sur les apprentissages en termes d'erreurs à ne plus répéter, ou encore de gains potentiels dans l'éventualité où des échanges constructifs avaient lieu pour résoudre les conflits. En effet, plusieurs chercheurs stipulent que les apprentissages groupaux sont favorisés lorsque les membres d'une équipe s'engagent dans des activités telles que vérifier les diverses suppositions soulevées, discuter ouvertement des divergences et différents, et ajuster les stratégies de fonctionnement suite à des erreurs (Edmondson, Bohmer, & Pisano, 2001). Ces activités permettent aux membres d'une équipe d'accroitre leur compréhension commune d'une situation donnée et de découvrir les conséquences d'actions antérieures (Burke, Stagl, Salas, Pierce & Kendall 2006).

Des recherches futures pourraient également tenter d'améliorer ou affiner certains instruments de mesure des construits investigués empiriquement dans cette recherche, même si les propriétés psychométriques des échelles actuelles sont bonnes. Par exemple, les résultats obtenus pour la mesure d'ouverture à la diversité révèlent peu de variance entre

participants, et il serait donc intéressant de pouvoir recueillir des données plus nuancées. À cet effet, certaines sous-dimensions de ce construit pourraient être captées avec plus de précision. L'échelle actuelle d'ouverture à la diversité inspirée de Hobman, Bordia, et Gallois (2003) est assez générale, et par le fait même, présente l'avantage de pouvoir être administrée dans plusieurs milieux. Cependant, certaines dimensions d'ouverture pourraient inclure des éléments plus précis. En particulier, en lien avec les sous-dimensions d'ouverture à diversité informationnelle (« *openness to informational diversity* ») et d'ouverture à la diversité de valeurs de travail, il sera fort pertinent d'évaluer plus précisément l'ouverture face aux différentes pratiques de travail, aux méthodes de travail, et aux théories inhérentes à diverses disciplines et milieux de travail. Une telle mesure serait particulièrement appropriée et utile dans les contextes interdisciplinaires, mais également dans les contextes interorganisationnels ou interinstitutionnels.

Tel que suggéré précédemment, avec une plus grande puissance statistique, d'autres variables du modèle de l'efficacité des collaborations complexes pourraient être ajoutées. Par exemple, les variables relatives aux caractéristiques compositionnelles groupales, au soutien exécutif et aux états émergeants n'ont pu être étudiées empiriquement étant donné la petite taille de l'échantillon. Des études futures comportant des cohortes importantes permettraient une compréhension plus fine et poussée des divers facteurs et dynamiques influents compris dans ledit modèle. Il va sans dire que de telles études pourraient être réalisées auprès d'échantillons diversifiés représentant divers contextes de collaborations complexes. Dans cet ordre d'idées, il est opportun de souligner que l'échantillon sondé n'a pas permis d'évaluer les variables du modèle de médiation multiple dans un contexte de

collaboration internationale. Par conséquent, il est possible que les résultats auraient été différents dans un tel contexte. Par exemple, la diversité visible est souvent plus saillante entre nations différentes, et peut engendrer certains stéréotypes néfastes au niveau des dynamiques de groupes. Les différentes cultures nationales abordent également des schèmes différents pour interpréter divers éléments du travail d'équipe, ce qui peut générer des attentes différentes quant aux rôles, à la participation, à l'intégration et aux objectifs (Gibson & Zellmer-Bruhn, 2002), complexifiant ainsi les processus collaboratifs. Plus la distance culturelle est grande entre nations, plus il y a de risque d'attributions erronées, de chocs culturels et de difficultés d'ajustement (Galarza, 1999). Il est donc possible que les conflits auraient été plus importants et plus influents dans ce contexte. Des recherches ultérieures en ce sens seraient donc requises. De plus, bien que les technologies de communication soient de plus en plus prévalentes dans tous les milieux de travail, les collaborations internationales tendent à recourir davantage à des équipes entièrement virtuelles. Celles-ci constituent un pan de recherche en soi. Les technologies de communication ont des impacts sur plusieurs processus d'équipe, dont notamment la planification, la communication, la coordination, et la supervision **(**Tannenbaum, Mathieu et Salas, sous presse**).**

Enfin, il serait fort opportun d'effectuer des études longitudinales dans des projets plus étendu afin d'évaluer l'évolution de l'effet des variables au cours des divers jalons du projet. Une étude longitudinale permettrait de capter la dynamique évolutive des équipes qui ont une histoire et un passé, et d'évaluer comment certaines variables peuvent en influencer d'autres à travers le temps. Par exemple, tel que suggéré par certains chercheurs

(Cabrera, Nora & Crissman, 2002; Walker, 2008), l'ouverture à la diversité se développe-t-elle à travers le temps par les interactions au sein d'équipes hétérogènes? L'impact de cette variable sur les processus collaboratifs et sur les conflits est-elle uniforme dans des projets plus longs présentant des défis et enjeux similaires? À ma connaissance, aucune étude à ce jour n'a investigué l'influence de cette variable dans un devis longitudinal. Les équipes représentent des systèmes dynamiques et adaptatifs qui évoluent à travers le temps et interagissent avec leur environnement. L'adaptation est donc un élément central de l'efficacité des équipes et est particulièrement importante lorsque les tâches ne sont pas routinières (Burke et al, 2006). Les différences entre membres quant à leurs perceptions, tendances et valeurs se traduisent en différences comportementales, ce qui exige de pouvoir s'adapter pour pouvoir travailler ensemble et se coordonner. À cet effet, il serait pertinent d'évaluer si l'ouverture à la diversité favorise une meilleure adaptation.

Mot de la fin

Tel que souligné dans les écrits les plus récents sur la collaboration dans les équipes de travail (Tannenbaum et al, sous presse), la nature des équipes ainsi que l'environnement dans lequel elles évoluent a considérablement changé au cours des dernières décennies. Par conséquent, de nouveaux besoins ont émergé, mais la recherche n'a pas toujours su s'ajuster pour composer avec ces besoins émergeants. Dans cette nouvelle ère, les équipes

de travail évoluent dans des environnements plus complexes, fluides et dynamiques qu'auparavant. Le temps est maintenant venu d'étudier les équipes et leurs dynamiques en dehors des balises et des définitions traditionnelles (Tannenbaun et al. sous presse), et par le fait même, en dehors des définitions traditionnelles des collaborations.

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Appendice 1

Formulaire de consentement des participants à l'étude (article 2)

Université de Montréal

RENSEIGNEMENTS AUX PARTICIPANTS

Objectifs de la recherche

Ce projet de recherche vise à mieux comprendre les divers facteurs qui favorisent le succès de projets complexes impliquant des équipes multidisciplinaires et interinstitutionnelles.

Participation à la recherche

Votre participation à cette recherche consiste à répondre à un questionnaire d'une durée approximative de 25 minutes.

Confidentialité

Les renseignements que vous nous donnerez demeureront strictement confidentiels. Chaque participant à la recherche se verra attribuer un code (indiqué ci-dessous) et seul le chercheur principal et/ou ses agents de recherche auront accès à la liste des participants et des codes qui leur auront été attribués. Aucune information nominative ne sera publiée ou transférée à d'autres et toutes les précautions seront prises pour préserver votre anonymat. De plus, le système informatique qui abrite le questionnaire est sécurisé et les renseignements seront conservés dans un classeur sous clé situé dans un bureau fermé. Ces renseignements personnels seront détruits 7 ans après la fin du projet. Seules les données ne permettant pas de vous identifier seront conservées après cette date.

Avantages et inconvénients

En participant à cette recherche, vous pourrez contribuer à l'avancement des connaissances dans le domaine de la recherche sur les projets et les équipes de travail non traditionnels. Cette démarche, qui nécessite un léger investissement de votre temps, vous donnera l'occasion de réfléchir sur vos méthodes de travail en équipe dans le cadre de projets complexes et interdisciplinaires comme celui de GreenStorming/TempêtÉco.

Droit de retrait

Votre participation est entièrement volontaire. Vous êtes libre de vous retirer en tout temps, sans préjudice et sans devoir justifier votre décision. Dans ce cas, les renseignements personnels vous concernant et qui auront été recueillis au moment de votre retrait seront détruits. Si vous décidez de vous retirer de la recherche, vous pouvez communiquer avec Hélène Essiembre.
Pour toute question relative à la recherche, vous pouvez communiquer avec Hélène Essiembre ou François Chiocchio.

Toute plainte relative à votre participation à cette recherche peut être adressée à l'ombudsman de l'Université de Montréal par téléphone au (514) 343-2100 ou à l'adresse électronique: ombudsman@umontreal.ca .

CONSENTEMENT

Je déclare avoir pris connaissance des informations ci-dessus, avoir pu poser mes questions sur ma participation à la recherche et obtenu les réponses, et comprendre le but, la nature, les avantages, les risques et les inconvénients de cette recherche.

Après réflexion
___ Je consens librement à prendre part à cette recherche tout en sachant que je peux me retirer en tout temps sans préjudice et sans devoir justifier ma décision
___Je préfère ne pas participer à la recherche et m'y retirer sans préjudice.

_____	_____	_____
Nom et prénom en lettres moulées	Signature	Date

Voici votre code d'authentification personnel dénominalisé: _____

Appendice 2

Instruments de mesure (article 2)

Échelle d'ouverture à la diversité

(adaptée de Hobman, Bordia et Gallois, 2003)

Consigne : Veuillez indiquer à quel point vous êtes en accord avec chacun de ces énoncés

Fortement en désaccord	En désaccord	Ni en désaccord ou en accord	En accord	Fortement en accord
①	②	③	④	⑤

Dans mon équipe…

1. Les membres ont aimé travailler avec des gens dont les valeurs de travail sont différentes des leurs.
2. Les membres ont aimé travailler avec des gens de différentes origines ethniques.
3. Nous avons apprécié travailler avec une équipe composée d'hommes et des femmes.
4. Nous avons apprécié travailler avec des gens de différents groupes d'âges.
5. Les membres ont aimé travailler avec des gens de diverses disciplines professionnelles.
6. Les membres se sont efforcés d'écouter le point de vue des gens dont les valeurs de travail sont différentes des leurs.
7. Les membres se sont efforcés d'écouter le point de vue des gens de différentes origines ethniques.
8. Nous nous sommes efforcés d'écouter le point de vue aussi bien des hommes que des femmes qui forment l'équipe.
9. Nous nous sommes efforcés d'écouter le point de vue des gens de différents groupes d'âges.
10. Les membres se sont efforcés d'écouter le point de vue des gens de diverses disciplines professionnelles.

11. Les membres ont aimé apprendre des gens dont les valeurs de travail sont différentes des leurs.
12. Les membres ont aimé apprendre des gens de différentes origines ethniques.
13. Nous avons aimé apprendre aussi bien des hommes et que des femmes qui forment l'équipe.
14. Nous avons aimé apprendre des gens de différents groupes d'âges.
15. Les membres ont aimé apprendre des gens de diverses disciplines professionnelles.

Échelle de travail collaboratif

(Chiocchio, Grenier, O'Neill, Savaria et Willms, sous presse)

Consigne : Veuillez indiquer à quelle fréquence les comportements suivants ont été adoptés au sein de votre équipe

Jamais	À l'occasion	Assez souvent	Souvent	Très souvent
①	②	③	④	⑤

Dans mon équipe…

1. ...nous nous sommes donnés de l'information utile qui a fait progresser le travail
2. ...nous avons partagé des connaissances qui ont fait avancer le travail
3. ...nous nous sommes compris lorsque nous parlions du travail à faire
4. ...nous avons partagé des ressources qui aidaient à la réalisation des tâches
5. ...nous nous sommes communiqué nos idées au sujet du travail à faire
6. ...nous avons fait le travail que nous devions faire au bon moment
7. ...nous avons fait en sorte que nos tâches étaient terminées à temps
8. ...nous nous sommes ajustés afin de respecter les échéances
9. ...nous avons fait le point au sujet de la progression du travail
10. ...nous nous sommes échangé de l'information au sujet de «qui fait quoi»
11. ...nous avons discuté de l'échéancier
12. ...nous avons anticipé les besoins des autres sans qu'ils aient à les exprimer
13. ...nous avons réorganisé nos tâches instinctivement lorsque des changements étaient nécessaires
14. ...nous avions une compréhension implicite des tâches à effectuer

Échelle de conflits

(adaptée de Jehn et Mannix, 2001)

Consigne : Veuillez indiquer à quelle fréquence les situations suivantes se sont manifestées au sein de votre équipe

Jamais	À l'occasion	Assez souvent	Souvent	Très souvent
①	②	③	④	⑤

Dans mon équipe…

1. ...il y a eu des tensions concernant les relations interpersonnelles
2. ...il y a eu des manifestations de colère
3. ...il y a eu des conflits mettant en jeu des émotions
4. ...il y a eu des conflits sur le plan des idées
5. ...il y a eu des divergences d'opinion concernant le projet
6. ...il y a eu des opinions conflictuelles au sujet du travail à faire
7. ...il y a eu des divergences d'opinion concernant « qui » fait « quoi »
8. ...il y a eu des conflits concernant la nature des responsabilités associées aux tâches
9. ...il y a eu des divergences d'opinions concernant l'allocation des ressources

Échelle de viabilité des équipes

(Jap, 2001)

Consigne : Veuillez indiquer à quel point vous êtes en accord avec chacun de ces énoncés

Fortement en désaccord	En désaccord	Ni en désaccord ou en accord	En accord	Fortement en accord
①	②	③	④	⑤

1. J'accueillerais avec plaisir la possibilité d'une autre collaboration avec cette équipe dans le futur.
2. J'accepterais de travailler à nouveau avec les membres de cette équipe.
3. J'accepterais de collaborer à nouveau avec cette équipe dans le futur, si l'occasion se présentait.

Échelle de performance d'équipe

(adaptée de Hoegl, Weinkauf, & Gemuenden, 2004 et Oguntebi, 2009)

Consigne : Veuillez indiquer à quel point vous êtes en accord avec chacun de ces énoncés

Fortement en désaccord	En désaccord	Ni en désaccord ou en accord	En accord	Fortement en accord
①	②	③	④	⑤

1. Notre équipe peut être considérée comme performante.
2. Tous les objectifs de notre équipe ont été rencontrés.
3. Le projet réalisé par notre équipe est de grande qualité.
4. Notre équipe a bien géré son temps.
5. Notre équipe a rencontré les échéanciers importants.

Évaluation de la performance de projet

Grille d'évaluation complétée par le jury

(1ière étape)

Équipe numéro _____ ; Juge _____.

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CRITÈRE 1	2. Cotation
Analyse du site et compréhension de la problématique et des enjeux ; pertinence du concept. Problèmes auxquels fait face le milieu (c.-à-d. les différents acteurs en présence)? Enjeux actuels et à venir en matière d'aménagement et de développement (c.-à-d. ce qu'on a à perdre ou à gagner)? Potentialités offertes par le site et son milieu (ce que le site et son milieu pourraient devenir en considérant ce qui existe déjà sur place, plutôt que ce qu'ils devraient être si on ne cherchait qu'à mettre en œuvre des principes théoriques déconnectés du site)?	Très faible ← → Très bon Faible / Moyen / Bon ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
1. Observations	**3. Justifications**

CRITÈRE 2	2. Cotation
Aspects innovateurs attachés au concept de développement urbain durable. Capacité à expliciter et/ou à mettre en avant les aspects du concept qui l'insèrent dans une démarche de développement urbain durable. Intégration des enjeux. Pertinence des critères écologiques, sociaux et économiques abordés. Présentations de solutions innovantes et/ou originales mais avec un degré relatif de réalisme (ne pas restreindre non plus l'innovation). Le concept et les axes de développement proposés doivent faire partie d'une stratégie explicitée et justifiée.	Très faible ← → Très bon Faible / Moyen / Bon ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
1. Observations	**3. Justifications**

CRITÈRE 3	2. Cotation
Qualité de la présentation et propension à « vendre » le projet. Aspects visuels (qualité des diapositives, des cartes, des photos). Aspects graphiques (pas de préférence entre une carte composée à la main et à l'ordinateur pour ne pas discriminer une équipe qui n'a pas de logiciel en sa possession étant donné que nous ne les fournissons pas). Construction de l'argumentation et propension à les exprimer.	Très faible ← → Très bon Faible / Moyen / Bon ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
1. Observations	**3. Justifications**

Grille d'évaluation complétée par le jury

(2ième étape)

ÉTAPE B – Juge _____.

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Équipe 1	**– 1 – Reportez votre évaluation initiale ici** ① ⇔ ⑨	**– 2 – Évaluation consensuelle après discussion en groupe** ① ⇔ ⑨	**– 3 – Justifications**
1. Analyse du site et compréhension de la problématique et des enjeux ; pertinence du concept.			
2. Aspects innovateurs attachés au concept de développement urbain durable.			
3. Qualité de la présentation et propension à « vendre » le projet.			
TOTAL			

Grille d'évaluation complétée par le jury

(3ième étape)

ÉTAPE C – Juge _____.

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Toutes les équipes	**– 1 –** **Reportez ici le total de l'évaluation rapporté à l'Étape B** ① ↔ ②⑦	**– 2 –** **Quel rang occupe cette équipe ?** ① ↔ ⑦	**– 3 –** **Réflexion individuelle :** **Basé sur vos observations durant les présentations et sur l'ensemble des discussions le rang est-il représentatif de la performance de cette équipe ?**	**– 4 –** **Après discussion en groupe :** **Quel est le rang final consensuel ?** ① ↔ ⑦
Équipe 1			☐ Oui ☐ Non, pourquoi ?	
Équipe 2			☐ Oui ☐ Non, pourquoi ?	
Équipe 3			☐ Oui ☐ Non, pourquoi ?	
Équipe 4			☐ Oui ☐ Non, pourquoi ?	
Équipe 5			☐ Oui ☐ Non, pourquoi ?	
Équipe 6			☐ Oui ☐ Non, pourquoi ?	
Équipe 7			☐ Oui ☐ Non, pourquoi ?	

Appendice 3

Résultats des analyses statistiques permettant de comparer
les coefficients béta entre échantillons (article 2)

Comparaison des coefficients bétas entre échantillons

	Échantillon 1		Échantillon 2		H0: Gr1-Gr2=0	
	Coeff	**ET**	**Coeff**	**ET**	**Z**	**sig**
a1	1,2954	0,3434	1,0800	0,4002	0,408	ns
a2	-1,3901	0,1342	-0,9108	0,2212	-1,853	ns
b1	4,3753	4,4981	6,8246	2,4651	-0,478	ns
b2	0,6340	11,5082	-3,3887	4,4606	0,326	ns
c	5,6706	2,9871	2,1507	3,6143	0,751	ns
c'	0,8842	15,9702	-8,3061	5,4249	0,545	ns
a1*b1	5,6676	4,3424	7,3703	3,3103	-0,312	ns
a2*b2	-0,8813	11,3119	3,0864	3,2875	-0,337	ns
TOTAL	4,7864	11,1246	10,4568	4,6177	-0,471	ns