EFFECT OF CARBON ALLIANCE NETWORK STRUCTURE ON ENVIRONMENTAL PERFORMANCE OF ORGANIZATIONS

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ABSTRACT

The effect of network structure on the sustainability performance of organizations in developing countries at ego network level is explored in this article. It is hypothesized that the alliance network structure affects environmental performance of focal actors. We focused on alliances between organizations to reduce emissions under Kyoto Protocol's Clean Development Mechanism, and propose that ego's network position, and structural holes in its network, affect its emissions reductions positively. Unequal alliance members' status in carbon network negatively influence ego's emission reductions, however common third party ties between carbon alliance members moderates the effects of position inequality. Theoretical frameworks of embeddedness (M. Granovetter, 1985;Uzzi, 1996) and social capital (Burt, 1992; 1995) underscore improved understanding of these relationships.

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INTRODUCTION

Scholars have traced the motivations of corporate environmental investments using many theoretical frameworks e.g. institutional theory (Sharma, 2000) resource based view (Hart, 1995) or combination of some theories (Bansal & Roth, 2000; Escobar & Vredenburg, 2010) giving rich insights on the motivations, and advantages of corporate environmental investments (Berchicci & King, 2007). However, studies exploring the role of social networks on corporate decisions to reduce their environmental footprint are fragmented. Carbon constrained future, which may lead to a crisis for organizations (Busch & Hoffmann, 2011), necessitates not only management of institutional actors, or accessing competitive resources, but also managing social or interorganizational network in which organizations are enmeshed. Such a strategy emphasizes the role of managing the relationships and connections with all the actors in a network. It requires structuring the network to maximize the shared benefits, to access to novel information, and to gain either strategic position (Burt, 1992) in the network to negotiate with partners at better terms, or to enhance trust and collaboration within interorganizational network to perform more effectively (Coleman, 1988). This study fills this gap in the literature. In this article, we explored the effect of alliance structure of ***ego network*** – focal firms with their alters/partners, on their performance to reduce carbon emissions. Our contribution lies in introducing social network analysis in the literature on environmental performance of organizations. We took different approach from studies which presented antecedents of environmental performance, or

competitive advantages it gives to organizations, through institutional theory and resource based view. Instead of linking organizational environmental performance with Regulatory and normative forces (Porter & Linde, 1995), existing capabilities (Christmann, 2000), resources (Hart, 1995), management attitude (Sharma, 2000), stakeholder pressures (Eiadat, Kelly, Roche, & Eyadat, 2008; Jeswani, Wehrmeyer, & Mulugetta, 2008) or concern to be efficient, and legitimate (Bansal & Roth, 2000), we attempted to enrich the literature by showing that organizations' social network also plays very important role in stimulating organizations to reduce their environmental footprint, which is shown to increase organizations' financial performance (Hart & Gautam Ahuja, 1996; Busch & Hoffmann, 2011).

Similarly research on network structure and sustainability has focused so far on stakeholders (Timothy J. Rowley, 1997; Roloff, 2007; Benecke, 2011) and that remains theoretical in nature . For example Rivera-Santos & Rufín (2010) discussed characteristics of bottom of the pyramid business network and argued implications for multinational companies. The question exploring network structure and sustainable performance is not well understood. Only few studies addressed this issue and that's too with case studies at dyadic level, for instance, (Akiyama, 2010), through case study showed that to manage CSR, middle managers increase their network density and network ties stronger. Likewise literature on consequences of network structure (Borgatti, Mehra, Brass, & Labianca, 2009; Zaheer, Gözübüyük, & Milanov, 2010) has rarely focused on organizations' environmental performance achieving of which may requires focus on managing interorganizational network for planet, and people, besides profits (Elkington, 1998). Antecedents and consequences of such network strategies significantly differ from conventional profit and growth orientations. For instance natural resources normally do not have price tag (Reinhardt, 2000), environmental information to make investment decisions is not readily

accessible (Bazerman & Hoffman, 1999), and it is very complex to evaluate natural disasters which may result into under investment in those resources (Kleindorfer & Saad, 2005). All such factors make formulation of investment strategies, to manage environment for strategic advantage, very challenging. However perspective of social or alliance network may help in managing these issues. For example to overcome the barrier of access to novel information (Bazerman & Hoffman, 1999), organizations may choose to manage their network in such a way that resulting network structure contain more structural holes (Burt, 1992) and weak ties to distant partners (Granovetter, 1973).This article aims to unearth this unexplored dynamic of organizational network structure and its effect on environmental performance.

We focused on alliances between firms under Kyoto's protocol Clean Development Mechanism. This way we aimed at comprehending the network dynamics between developed and developing countries' organizations. Following (Gulati, 1998), we defined ***alliances*** as voluntary collaboration between two or more entities where each entity share, and exchange information and resources, and value they earn in return doubles than each of the entity would earn independently. Interorganizational alliances and partnerships to reduce carbon emissions in developing countries are referred here as ***carbon alliance network*** and we checked its affect on organizations' environmental performance. Treating environmental performance as outcome variable (Busch & Hoffmann, 2011), we used emission reductions under Clean Development Mechanism (CDM hereinafter), as our dependent variable. Emission reductions under CDM captures the three dimensions of triple bottom line (Elkington, 1998) as CDM has in-built clause to bound carbon alliance partners in developing countries to invest part of carbon (planet) credits' proceeds (profits) on social projects (people). Further focus on inter-organizational alliances under CDM aimed at exploring the role of alliances, on the performance of developing countries'

organizations. In the following paragraphs, after giving brief literature review on CDM, we build theoretical framework to analyze the role of carbon alliance network on focal firms' environmental performance. We will use corporate environmental performance, emissions reductions under CDM, or emission reductions interchangeably.

CDM MARKET

Kyoto Protocol's Clean Development Mechanism helps developed countries meet their emission quotas at lower than domestic abatement costs. Trading of carbon credits generated through this flexible mechanism (Lecocq & Ambrosi, 2007; Paulsson, 2009) is used as a strategy to compensate costs incurred by organizations in developed countries to adapt to climate change (Kolk & Pinkse, 2005). Clean development mechanism (CDM hereafter) also gives opportunity to developing countries' entities to get innovative environmental technologies from industrialized countries (Olsen, 2007; Pinkse, 2007; Sutter & Parreño, 2007; Petersen, Escobar, Espinoza, & Vredenburg, 2006; Schneider, Holzer, & Hoffmann, 2008). There are number of CDM advantages that are demonstrated in the literature on CDM. Scholars (Haites, Duan, & Seres, 2006; Schneider et al., 2008; Seres, Haites, & Murphy, 2009 ; Dechezleprêtre, Glachant, & Ménière, 2008) have showed that CDM facilitates transfer of environmentally friendly technologies, human skills and institutional capacity to manage projects from developed to developing countries (Haites et al., 2006; de Coninck, Fischer, Newell, & Ueno, 2008). CDM lowers the barriers of projects' commercial viability by increasing its internal rate of return, access to information via stakeholders and intermediaries, and access to capital (Schneider et al., 2008). It also gives first mover advantages to organizations in emerging economies (Petersen et al., 2006) and because of new CDM value chain (Dechezleprêtre et al., 2008; Schneider,

Hendrichs, & Hoffmann, 2010), it potentially facilitates sharing of knowledge and formation of alliances that can enhance the host firms' innovative capabilities (Schneider et al., 2008).

The process of commissioning a CDM projects starts with approval from designated national authority of host organizations which approves project design documents – formal document detailing technical aspects, prospective emission reductions and sustainable development benefits. Project owner, organization or NGO, either develops projects themselves which is termed as unilateral projects (Lütken & Michaelowa, 2008) or specialist intermediaries, project developers, consultants etc., help them in this regard. Similarly ***project participants*** i.e. legal CDM project partners, from developed country can also approach approving authority, finds suitable projects to invest, and partners to select from developing country. Once a project is approved by host country, validated by an authorized intermediary that it meets eligibility requirements of CDM, project is registered by CDM Executive Board. Tradable ***Certified emission reduction*** (CERs), are issued to project participants after verification and certification of operational entities – another accredited specialist.

In the following pages, we build theoretical mechanism to propose network characteristics which may influence organizations' emissions reductions under CDM. We worked at ego network level, and looked how network of focal firms in developing countries, our egos, affects their environmental performance.

THEORETICAL FRAMEWORK

Research on the role of ***network structure***, defined as "the pattern of relationships that exist among a set of actors" (Phelps, 2010): 890), is traced to the works of Moreno (Moreno & Jennings, 1934) who, while analyzing the reasons of runaways of fourteen girls from Hudson

School for Girls using sociometry, argued that runaway girls got unconscious social influence due to their positions in social network which determined their decision to leave the school (Borgatti et al., 2009). Later French sociologist Durkheim (Durkheim & Simpson, 1951) argued that "reasons for social regularities were to be found not in the intentions of individuals but in the structure of the social environments in which they were embedded" (Borgatti et al., 2009: 892). Works of Granovetter (1973, 1985), Coleman (1988), Burt (1992) and many other scholars (Nohria & Eccles, 1992) sparked academic interest in social networks (Borgatti & Foster, 2003); (Zaheer et al., 2010). Social and organizational network characteristics and structure are now increasingly used in the literature to check its performance benefits (Borgatti & Foster, 2003) and even to comprehend the complexities of financial crisis due to interconnectedness of economies (Schweitzer et al., 2009). Literature on social network has increased manifold (Kilduff & Brass, 2010) and so does application of social networks in organizational research (Provan, Fish, & Sydow, 2007). Two theoretical perspectives, embeddedness (Granovetter, 1985, Uzzi, 1996) and social capital (Burt, 1992) are referred to devise our Hypotheses.

Embeddedness

It is defined as the "process by which social relations shape economic actions" (Uzzi, 1996:674) and "actors are embedded within a network to the extent that they show a preference for transacting with network members or to the extent that social ties are forged, renewed, and extended through the community rather than through actors outside the community" (Kilduff & Brass, 2010:319). Presenting an alternative theory on economic exchange and institutional structure, Granovetter (1985) proposed a novel framework to understand economic actions in social context, and put forward a middle-way between two perspectives of economic actions i.e. over-socialized and under-socialized economic actions and consequential order in society. In the

over-socialized view, actors are treated as overly socially sensitive and make only normative and socially internalized economic decisions. Whereas in under-socialized perspective, economic actors are treated as rational beings that make economic decisions without regard to social relationships. It is posited that "actors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy. Their attempts at purposive action are instead embedded in concrete, ongoing systems of social relations" (Granovetter 1985:487). Embeddedness theory further highlights the role of economic actors' embeddedness in social network in generating order, trust, and rich information to transact with known and reputed persons, and that opportunistic behavior of partners to an economic exchange is "policed by quick spread of information about instance of malfeasance" (Granovetter, 1985:492). Later on literature on interorganizational alliances evidenced the benefits of having embedded ties. For example (Gulati, 1999) found that social context, interdependence, and firms' past alliance network affects their decisions to enter into new alliances. Alliance network, past or present, helps firms access to reliable information about potential partner's capabilities, check the opportunistic behaviors of partners (Gulati, 1995), 1999).

Social Capital

Building on the argument of social embeddedness of economic actors (Granovetter, 1985) and benefits of having weak ties (Granovetter, 1973) with other players, Burt (1992) presented the formal causal model using structural hole arguments i.e. players with non-redundant contacts generate more network benefits of information, referral and control. The utilitarian advantages of having peculiar network structure develops into theory of ***Social Capital,*** defined as the advantage created by location in social structure (Burt, 1992), and that structure of individual or

organizations' network facilitate coordinated action, access to resources and determines in part firms' competitive advantage (Burt, 1992). Research on inter-organizational networks have confirmed the role of social structure of organizations and their financial (Bae & Gargiulo, 2004)) and innovation performance (Ahuja, 2000; Phelps,2010). However, two competing stream of research argue convincingly which network structure is beneficial. Burt (1992) argues that network rich with structural holes brings referral, information and control benefits to focal actors, whereas Coleman (1988) shows that closure does. In closed network, ego's alters are connected with each other. Such cohesion is shown to be source of trust and effective group performance. However later scholar showed the contingent effects of time (Zaheer et al., 2010), and that some networks can enjoy exploratory innovation linked with structures holes and effective performance linked with closure. For example recently Phelps (2010) demonstrated that densely interconnected alliance network with diversified and innovative network members influence exploratory innovation of focal firms.

Gaining insights from above literature on i.e. embeddedness (Granovetter, 1985, Uzzi, 1996) and social capital (Burt, 1992, Coleman, 1988), in the following pages, we will build our theoretical mechanism to discern network characteristics which might affect focal firms' environmental performance.

Hypotheses

Network Position, defined as organizations' positions in a network and their number of direct ties (Freeman, 1978; Wasserman & Faust, 1994), determine in part which channels of information, and what resources they have access to in their network. Position in fact is the role an organization occupies (Gulati & Gargiulo, 1999), and the more central position an

organization occupies in a network of relationships or alliances, the more information, reputation, power and other benefits it can enjoys (Burt, 1992; Ahuja, 2000; Yang, Lin, & Peng, 2011), however in some cases such performance benefits is shown to decrease after a certain threshold (Lechner, Frankenberger, & Floyd, 2010). Central firms, due to their direct links in their ego network, have more chance to timely access to new information compared to their counterparts in the industry (Gulati, 1995; Ahuja, 2000; Zaheer et al, 2010). As such connecting with other actors in a network increases visibility, and reputation, central organizations have more chance to attract more resourceful partners (Yang et al., 2011) to form stable alliances (Polidoro Jr., G Ahuja, & W. G. Mitchell, 2011) which in turn translates into higher performance benefits (Ahuja, 2000; Tsai, 2001). Scholars (Reinholt, Pedersen, & Foss, Forthcoming); Ahuja, 2000; Tsai, 2001) have shown that knowledge and complementary skills are shared with centrally positioned focal actors in a network which make them more innovative (Tsai, 2001; Ahuja, 2000). In CDM projects, developing countries' organizations are relatively at a disadvantage due to lack of access to technology, information and know-how (Schneider et al., 2008; Jeswani et al., 2008)) about how to improve their environmental performance. In this case focal firms' central position is more likely to give them relative advantage to access more information, knowledge, and technology. Though initially little effort is required to reduce pollution, particularly in mature industries where there is a large scope to curtail carbon footprint by introducing small changes in manufacturing processes. However central firms, thanks to their direct relationships and links in the CDM markets, can access to new methods of reducing emissions, resources, information and technology by either tapping the information pool reside in the network (Burt, 1992), or by attracting and forming partnerships with more resourceful

organizations. Therefore we propose that centrally positioned firms will outperform their competitors in the industry.

H1: Environmental performance of those focal firms in the developing countries will be higher which are centrally positioned in the CDM market. (or there is a positive relationship between network position and environmental performance of organizations in developing countries)

Position Inequality, refers to the condition when alliance members occupy different network positions. Network position, on the one hand accrues certain benefits to firms, however in some cases relative advantageous position increases friction between project participants due to power (Greve, Baum, Mitsuhashi, & Rowley, 2010) and reputation inequality (Podolny, 1993) if alliance members enjoy different status brackets. When central firms form alliances with peripheral firms, they do so to access diverse pool of complimentary resources (Ahuja, 2000; Gulati & Gargiulo, 1999), however there are some costs to bear to collaborate with peripheral firms such as damage to reputation (Polidoro Jr., Ahuja, et al., 2011), or giving more reputational benefits to peripheral firms (Ahuja, Polidoro Jr., & Mitchell, 2009). Similarly if focal firms are peripheral in a given network, costs associated with partnerships with resource-rich central firms may shadow benefits of such a relationships as powerful partners (Mizruchi, 1982) may constrain behavior of peripheral firms, assert terms favorable to powerful partners only (Bae & Gargiulo, 2004). Position inequality then is a source of friction. However such a difference in structural status of project participants is unavoidable in CDM market, as project participants from developed countries are mostly carbon intermediaries who have access to many actors, and

enjoys relative powerful negotiating positions which constrain the behavior of focal firms (Greve et al., 2010). If project participants occupy different network positions, there is high possibility that their relative position may give them chance to assert and dictates terms, which only increases friction (Polidoro Jr. et al., 2011; Greve et al., 2010) and results into either breakdown of relationships or restrictive flow of information and knowledge in the network. Reducing emissions under CDM requires access to technologies, and novel knowledge, and friction due to position inequality may influence organization' environmental performance negatively. Therefore we propose that position inequality between alliance members in the CDM market negatively influences the environmental performance of organizations

H2: There is a negative relationship between position inequality and environmental performance of developing countries' organizations in CDM market.

Structural Embeddedness, defined as to the "extent to which a given pair of organizations shares common partners from past ties" (Gulati & Gargiulo, 1999). Referral, social monitoring benefits, and deterrence based trust are shown to emerge from having common partners (Polidor Jr. et al, 2011). Referral advantage gives weaker organizations an opportunity to make partnership with powerful or central organization which results into access to relatively superior resources. Structural embeddedness also stems opportunistic behaviors of alliance members. Because of being structurally embedded, norm breaking behaviors get greater visibility (Polidora Jr. et al, 2011), which makes it difficult for notorious firms (Granovetter, 1985, 1992; Gulati & Gargiulo, 1999) to tap outside resources or make partnerships e.g. for research and development, with suppliers etc. Further structural embeddedness is found to affect alliance formation (Gulati, 1995; Gulati & Gargiulo, 1999) and increase alliances survival (Polidoro Jr. et al, 2011) which

saves organizations' cost to search and make new partnerships. Uzzi (1996) found that apparel firms in New York increased their survival rates by socially embedding in their business networks. Polidor Jr. et al (2011) shows that structural embeddedness help firms overcome friction in their relationships and that common partners, and history of interactions strengthen ties between alliance partners. Network embeddedness increases cohesion (Coleman, 1988) between alliance members, and help them address challenge of friction (Greve et al, 2009) which may arise due to resource scarcity and incompatibility. For example Bae and Gargiulo (2004) found that focal firms in telecommunication industry mitigate the friction that may arise by associating with resource-rich non substitutable organizations, by embedding in third party common ties. Under CDM, projects take months to materialize and pass all stages of approval process. Large amount of resources is spent to commission emission reduction projects. Such an endeavor bears fruit, in the form of carbon credits, legitimacy etc., after months of painstakingly hard work. Joint ventures is considered as a mechanism to check the opportunistic behaviors of alliance members, and to tie them formally to a common goal (Gulati, & Gargiulo, 1999), however there is less tendency to form joint ventures in the CDM market e.g. only four joint ventures were found to exist in the CDM market (Seres et al., 2009). As such project participants contract long term partnerships to reduce emissions of host firms in developing countries, therefore such an arrangement necessitates some mechanism to ensure alliance members respect laid down rights, and holds on to partnerships, and functions smoothly despite position asymmetries or uncertainties inherent in CDM market, particularly when carbon credit buyers occupies relatively powerful bargaining positions (World Bank, 2011[1]). Social relationships around focal actors influence their tendency to cooperate with each other (Granovetter, 1985),

[1] State and trends of the carbon market 2011 repot, published by World Bank Carbon Finance Unit (available at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_Updated_June_2011.pdf)

which in CDM market context, is proposed to abet alliance members or project participants to negotiate with third parties as one entity, and to trust (Coleman, 1988) and share proprietary and reliable information with each other. Uzzi (1996) found that "organizational networks operate in an embedded logic of exchange that promotes economic performance through inter-firm resource pooling, cooperation, and coordinated adaption" (Uzzi, 1996: 675). He, empirically showed that apparel firms in New York increased their survival rates by socially embedding in their business networks. Therefore we propose that common third party ties, of asymmetrically positioned alliance members or project participants, will moderate the negative effects, of their unequal positions, on their environmental performance.

H3: Structural embeddedness moderates the effects of position inequality on the environmental performance of organizations (in developing countries in CDM market)

Structural Holes

So far we have argued that network position, and position inequality of organizations in developing countries, will affect their environmental performance, and structural embeddedness will mitigate the effect of position asymmetries on environmental performance. In this section we analyze whether connection between third parties are beneficial for focal actors. This refers to the debate of network closure and network openness. The formal approach argues an ego's network where alters are also connected as it brings social capital (Coleman, 1988), in the form of trust, and social monitoring. Equally plausible arguments of Burt (1992) favors a network in which redundant contacts between ego alters hinders ego's access to new information, and that

network rich in *structural holes* i.e. when alters are not connected with each other, gives advantage of access, timing, referral, and brokerage to focal firms. Network closure arguments revolve around mutual trust and reciprocity (Coleman, 1988; Zaheer et al, 2010), whereas notion of competition is invoked for having non-redundant contacts (Burt, 1992; Borgatti et al, 2009). Networks rich in structural holes accrues advantages of referral, timely access to new information, and brokerage (Burt, 1992, 1997; Lechner et al., 2010) by controlling the collusive behaviors of partners or pitting them against one another to obtain favorable benefits. Structural holes are shown to increase diversity of information, and innovation (Lechner et al, 2010). (Burt, 1997) argued that control benefits, by having structural holes in a network, are entrepreneurial in nature as focal actor "adds value by brokering the connection between others" (Burt, 1997: 342). Most of the CDM projects were shown to be unilaterly initiated by project hosts, and project participants from developed countries join later (Lütken & Michaelowa, 2008). Such a situation necessitates that focal actors have diversified channel of information and knowledge about how to improve their environmental performance, which is financially rewarding and strategically competitive. Secondly developing countries are Therefore we propose that environmental performance of those focal actors will be higher who has no redundant contacts in their CDM network.

H4: Structural holes are positively related to the increased environmental performance of developing countries' organizations.

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FIGURE 1 HERE
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METHOD

Under CDM, ideally manufacturing firms from developing and developed countries form alliance. For example in one project in Pakistan, Pakarab Fertilizers and Mitsubishi Corporation are "project participants", means they have equal rights to negotiate with consultants, respond to CDM queries and audits etc. However due lucrative incentives of generating carbon revenues from emission reduction projects, developing countries' companies are increasingly completing whole project cycles without seeking an alliance or partnership from developed country. Such an arrangement perhaps gives them some flexibility and better carbon prices. Two types of inter-organizational relationships in CDM market are found to exist (refer Box 1). In some cases firm A (focal firm) gets technology, and competencies from Firm B, to commission the CDM project to reduce carbon emissions. Firm A sells carbon credits to Firm C which in turn trades these carbon credits in emissions trading markets. In this case firm A may finance projects against future carbon credits' proceeds. However in many cases, under contract with firm A (CDM host), firm C arranges the whole CDM process flow or own the project costs from the very beginning with the sole propose of gaining the exclusive rights of buying carbon credits.

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BOX 1 HERE

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As of August 1st, 2011, 3337 CDM projects were registered, 3109 were at validation stage, and 113 were in the process of registration. 2730745 kCERs (certified emission reductions – tradable carbon credits generated through CDM projects) were expected, being sold at 8.16 euros

per ton in over the counter carbon markets[2]. China was major producer of CERs, with 54.7% of the CERs share, from 2727 projects, followed by India with only 15.4% from 1698 projects.

However European Union is planning to encourage investments in least developing countries after 2013, by putting pressure on rich developing countries such as China, to do more to fight for climate change. For instance analysts'[3] states that EU plans not to accept CERs from CDM projects commissioned in China after 2013, despite Chinese plan to impose absolute emission caps on iron, steel and cement sectors which are biggest contributors of emissions and so CERs credits.

The largest category of CDM projects are in renewable energy sector which include Biomass energy, geothermal, hydro, solar, tidal, and wind. However project category labeled as HEC, PFC & N20 has generated more CERs i.e. 70% CER as compared to 16% from renewable, however percentage of expected CERs from renewable projects will surpass by 8% as there will be 35% CERs from renewable projects until 2012.

Data and Sample

CDM is primarily project based market. Difficulty lies in selecting the sample. We focused only on those projects in which two or more firm entered into partnerships to reduce emissions under CDM. Our focus was the long term partnerships between project participants[4], each one of which has to be involved deeply with each other to carry out their responsibilities, commission projects, and sell carbon emissions under CDM. This partnerships and relationship besides being

[2] Source: Thomson Reuters' Point Carbon.
[3] Source: Thomson Reuters' CDM & JI Monitor, published on 1st of August, 2011 and available at http://www.pointcarbon.com/polopoly_fs/1.1567691!CJM20110809.pdf
[4] Kindly see rights of project participants on this link (http://www.cdmrulebook.org/69).

commercial, have aspects of strategic nature due opportunity to exchange knowledge, management processes, ideas etc. Relationship between project participants, from developed and developing countries', lasts till project life which is approx more than five years.

We selected only publicly listed companies, in line with existing literature (Ahuja, 2000), of China where authorities approves mainly bilateral projects. Data on CDM projects was obtained from The Institute for Global Environmental Strategies, CDM Pipeline, and UNFCCC, whereas firm level information were fetched from MintGlobal, companies' websites, and financial reports. Carbon price data was obtained from CDM Project Manager, and ICE ECX Exchange.

"WORK-IN-PROGRESS"

Variables

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TABLE 1 HERE
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FEEDBACK

We need reviewers' feedback on following issues:

There is possibility that focal firms' performance may have caused desirable network structure instead of other way around. In this case, how to address the problem of endogeneity, and how to control reverse causality? We introduce a control variable "CER Prices" (refer Table 1), however the latest CER price data available is from 2005, whereas our first crediting period starts from 2000. Should we limit our analysis and focus only on projects which started

generating credits after 2005, and in such case should we ignore first movers? For the variable, " network position", we planned to take relationships between project participants only, ignoring actors from the network which were paid to offer services. However one of such consultant i.e. project design document consultant might pass on vital information to CDM host, influencing their performance. Can we take such consultants in forming adjacency matrices? How to control the differential effects of having different nature of projects, for example HFC 23 projects are reportedly generate more credits at less cost. Should we focus only on same type of projects? Can we totally ignore unilateral projects, given the fact that such firms might be considered more innovative and that they may rely on their inner resources only? We argued and tried to differentiate between common third party ties of focal actors "structural embeddedness" and ties between common parties "structural holes", however we need input how to handle the situation when two variables cancel out effects of each other at some stage?

RESULTS

This section is "WORK-IN-PROGRESS". We expect to present the results in the main conference.

DISCUSSION & CONCLUSION

"WORK-IN-PROGRESS"

There are some limitations in our study. We focused only on alliances between project participants in the CDM markets. However possibility that focal firms' alliances beyond CDM may influence their environmental performance can not be ruled out. This, network boundary issue, was challenging. Nevertheless our focus was focal firms' environmental performance, so we focused only on ties and ego network of our focal firms in the CER primary market.

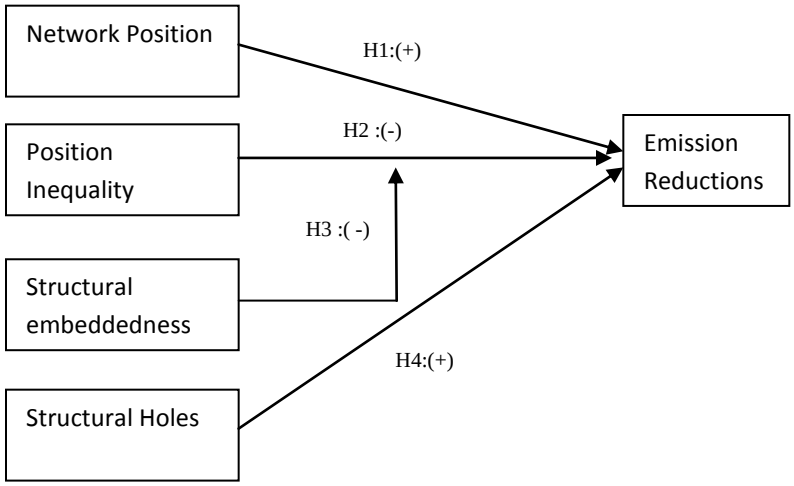
Although, we tried to control influence of secondary CER markets on focal firms environmental performance, however we did not look into the literature on investment financing, and oversight of markets. Secondly we took network structure as static, despite various studies arguing dynamic nature of networks (Gulati, 1995). However we leave it to future researchers to address above issues.

"WORK-IN-PROGRESS"

REFERENCES

References are available with the authors

Figure 1: Efffect of carbon alliance network structure on emission reductions of organizations



Box 1: Types of relationships and entities in the CDM market.

There are two types of relationships that exist in CDM market.

LONG TERM :

1. Project Participants: Project hosts in developing country, and carbon buyers in developed countries.
2. Verifiers: Before issuing tradable carbon credits by UN secretariat, project participants has to furnish a report by independent verifier - kind of auditor who furnishes monitoring or verification report that reported emissions are reduced. Verifiers involves in the project till projects' life span which might last beyond 5 years on average.

SHORT TERM

1. Consultants for project design documents – PDD. They help firms prepare documentation, and get approval from UN.
2. Validator: confirms that project documents are accurate, and comment on some technical aspects of projects.
3. Suppliers of technology - (equipment and knowledge). Some suppliers also give license to project participants to manufacture equipment.
4. Contractors to build, install or commission projects' machinery/equipment/process.

Besides above long term and short relationships, entities involved in projects are of different types:

1. Multinational companies (carbon buyers), their subsidiaries (host firms in developing countries).
2. Private firms (host firms and carbon buyers)
3. NGOs (Project hosts)
4. Government Ministries: both project hosts and carbon buyers from developed and developing countries, either directly or represented by some private firm
5. Credit buyers, local and foreign suppliers, banks etc.
6. Financial and multilateral development institutions e.g. World Bank etc.

Sources: Schneider et al (2010) ; World Bank Carbon Finance Unit ; Point Carbon ; CDM Pipeline, UNEP Risø Centre

Table 1: List of variables

Variables	Description	Dept/Ind/Control	Expected Effect	References
Emissions reductions	Proxy of environmental performance. Emission reductions from CDM projects only.	Dependent Variable	n/a	Busch & Hoffmann, 2011
Network position	Degree centrality	Independent variable	+	Ahuja, 2000; Swaminathan & Moorman, 2009.
Structural holes	Non-redundant contacts or no relationships between common third partners of focal actors.	Independent variable	+	Burt, 1992; Bae & Gargiulo, 2004
Position Inequality	Differential statuses or network positions of alliance members	Independent variable	-	Polidoro Jr. et al, 2011
Structural embeddedness	Common third party ties	Moderator	Moderate the negative effect of position inequality	Gulati & Gargiulo, 1999; Polidoro Jr. et al. 2011
Relationships between project participants	To control the effects of different nature of relationships between project participants	Control	n/a	Lütken & Michaelowa,2008.
Different projects	To control the effect that different nature of project may generate different level of emissions	Control	n/a	n/a
Price of carbon	To control influence of CER prices on project owner's decisions to reduce emissions	Control	n/a	n/a
Network Size	The control the effect of number of partners in a network of focal firms	Control	n/a	Uzzi, 1996; Bae & Gargiulo, 2004
Repeated ties	Experience of entering into alliances with same partners may influence their cooperation, and results into differential effects on actors' emissions level	Control	n/a	Gulati, 1995
Firm age, organization size, sector, liquidity, profitability, business group affiliation	To control the effects of firm level variables	Control	n/a	Polidoro Jr. et al., 2011; Ahuja, 2000; Gulati, 1995 ; Lechner et al., 2011 ; Lu & Ma, 2008