CARBONOMICS:
THE DIFFUSION OF GLOBAL CLIMATE POLICY
FROM THE LENS OF NEO-INSTITUTIONAL THEORY

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Abstract

This study contributes to understandings of the construction of the carbon economy (termed carbonomics) and its effects on the evolution of the contemporary industrial landscape. Starting from a supranational level, this paper demonstrates how neo-institutional theory provides insights to understand the ways by which countries can craft their carbonomics policy architectures. In particular, this paper broadens the application of the neo-institutional theory of organisational practices to a country-level analysis in order to understand their attempts to reduce global atmospheric pollution.

By summarising the carbon policy and regulations of major developed and developing countries which together have contributed more than 75% of global emissions, this study aims to explore how they incorporate the global carbonomics institutions in their carbon policy architectures. Three selected countries are studied to reveal different roadmaps, albeit with some considerable degrees of similarity, for designing and implementing their climate policies to curb emissions. The case studies also shed light on which highly polluting industry sectors have been affected by the carbon policies in various jurisdictions. Because each policy and its supporting regulation entail compliance costs and promulgate certain rules to be followed, the impact of carbon policies must be taken into consideration into future research examining contemporary industrial organisation as the world moves into a low carbon economy.

Keywords: the Kyoto Protocol, carbon emissions, greenhouse gases, climate change, ETS, policy, neo-institutional theory

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1 INTRODUCTION

It has been extensively documented by scientists working under the auspices of the Intergovernmental Panel on Climate Change (IPCC) in their First to Fourth Assessment Reports (see IPCC 1990, 1995, 2001; 2007, for details and progress) that global warming is happening. These and other reports suggest that the reliance on fossil fuels energy urgently needs to be reduced. However, this involves two serious and entangled problems – climate change and energy security. The transition into alternative energy is one of the keys for moving into a low carbon world. To this end, the most influential international treaties that have encouraged countries to join global action to halt anthropogenic climate change have been the 1992 United Nations Framework Convention on Climate Change (UNFCCC) and the 1997 Kyoto Protocol (the Protocol, hereafter).

Academic discourses on the implementation of climate policy and the ensuing regulation from a holistic viewpoint is sparse; this study aims to help fill this gap. A few studies, for instance Schaltegger and Csutora (2012) and Stechemesser and Geunther (2012), have considered these issues on a multinational scale, but both focussed on the notion of carbon accounting. Most of the literature has examined practices relating to carbon emissions at the corporate level (for instance Beermann 2011; Filimonau et al. 2011; Lee 2011; Pellegrino & Lodhia 2012; Scipioni et al. 2012). Only Hilden (2011) has specifically evaluated the evolution of climate policies by providing a case study on how Finnish government has developed its climate strategies.

There have been various moves to implement climate policies in many countries. The goal of this paper is to understand the construction of the carbon economy and identify its impact on business in various jurisdictions. We use the term the carbon economy (termed carbonomics) to describe an economy which has been imposing climate policies and regulations to control carbon emissions as the world moves into a low-carbon community.

The paper first discusses neo-institutional theory which is used to conceptualise the emergence and diffusion of carbon-conscious institutions in the global community. More specifically, it emphasises how and why countries' roadmaps towards a low carbon future tend to resemble each other in practice. We believe that this is the first time that institutional theory has been applied to country-level analysis in terms of the effort to clean up global atmospheric pollution. The next section summarises the milestones of global climate change negotiations and policies which have driven various effects and responses between countries. This is followed by a discussion on how individual countries have taken up the challenge to tackle anthropogenic climate change and mitigate its impacts through various but similar carbon policy adoption mechanisms. These architectures of carbon policies and regulations in three selected regions/countries, the EU, Australia and China are used as case examples in the section that follows. Next, using the lens of institutional theory, a discussion of isomorphism in carbon policy and regulation is presented. The final section provides our conclusions.

2 NEO-INSTITUTIONAL THEORY IN CARBON POLICY ANALYSIS

Many theories and models exist to analyse the creation and application of public policy, such as the institutional model; process model and rational model. The *rational model* assumes that policies evolve from a process of making logically sound decisions, mainly in the public sector. It theorises that the government is a rational and unitary actor and that its actions are perceived as rational choices valid competing alternatives. As the model must be applied in a

system that is stable, we found it inappropriate for analysing carbon policies from a global perspective, as these are currently in a high state of flux. The *process model* has been criticised for being overly linear and simplistic, as in reality the required stages of the policy process may overlap or never happen. Also, this model fails to take into account the multiple actors attempting to influence the process itself as well as each other, and the complexity that this entails. Thus we choose to apply the *institutional model* in which public policy is theorised to be determined by political institutions, which give policy legitimacy. Governments universally apply policy to all citizens in society and typically monopolise the use of enforcement in applying policy (although for some policies like antitrust, private enforcement is also possible). The legislature, executive and judicial branches of government are examples of institutions that give policy legitimacy.

The institutional model also helps to provide an understanding of how and why organisations in society behave as they do, through an examination of their institutions. Loosely defined, institutional theory considers the processes by which structures, including schemas, rules, norms, and routines, become established as authoritative guidelines for social behaviour (Scott 2004). Neo-institutional theorists (see Greenwood et al. 2008, for a comprehensive review) share a common view that organisations tend to adopt an increasingly similar template of institutions over time, as they conform to societal expectations. Conforming to society's expectations in particular is the manifestation of a desire to maintain societal legitimacy.

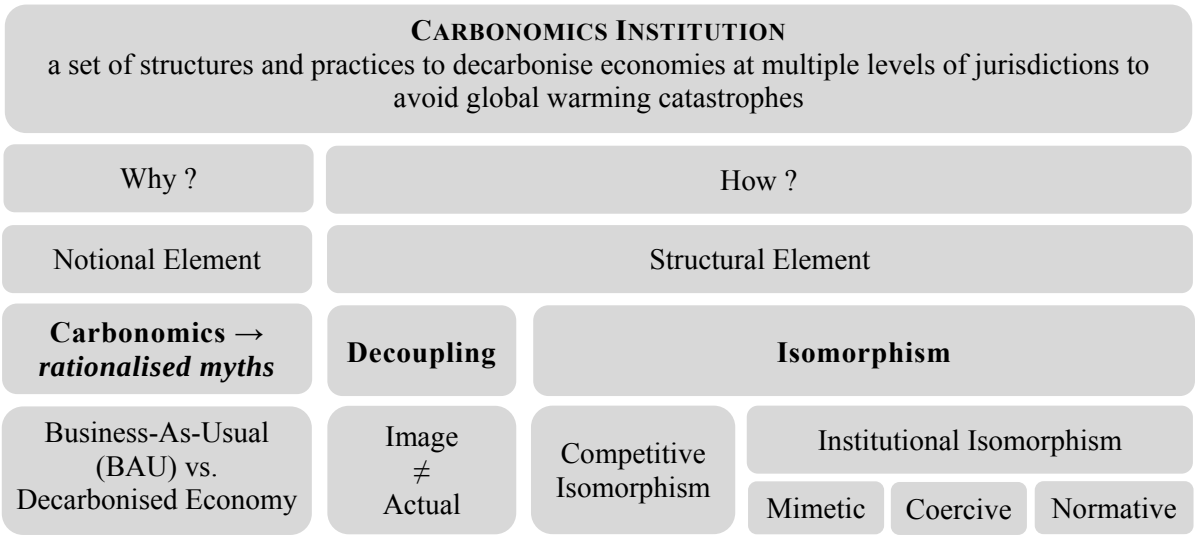
Borrowing from legitimacy theory (Suchman 1995), the increasing community awareness on climate change and its dangerous impacts represents a change in social norms, values and definitions. This change in accepted beliefs calls for actions to cut carbon emissions to lower their atmospheric concentration. The legitimacy gap initially defined by Sethi (1978) in this context is the disparity between business-as-usual (BAU) − whereby there is no policy imposed on emissions reduction − and society's expectations that business will implement real action to decarbonise the economy. In narrowing down this carbonomics legitimacy gap, the lens of neo-institutional theory can be applied to understand how and why escalating social pressures to introduce actions on climate change shape the increasingly similar pathways that countries are taking to embed carbon-consciousness in their economies. Using the lens of neo-institutional theory, we sketch the emergence and diffusion of the carbonomics institution as shown in Figure 1.

Policies evolve from the choices made within a set of institutions (North 1994). The society-wide understanding, termed *rationalised myths*, of anthropogenic climate change and its threatening impacts, provides the emerging *institutional context*. Society seems to increasingly perceive carbonomics as more appropriate than BAU as the existing practice. We can define a *carbonomics institution* as comprising a set of structures and practices to decarbonise economies at multiple levels of jurisdictions in order to avoid global warming catastrophes.

Neo-institutional theory advocates that responses to generally accepted carbon-conscious beliefs and norms within society can take two major forms, known as *decoupling* and *isomorphism*. In practice, the real institution – structures and procedures − happening within an organisation may not match its external appearance. For instance, official policies and procedures to lessen the carbon footprint which have been disclosed to the public via corporate websites may not really happen in daily practice. This phenomenon is termed

decoupling (Meyer & Rowan 1977). This incongruence between public imagery and actual actions is beyond the scope of this study.

Figure 1 Neo-institutional theory: The emergence and diffusion of the carbonomics institution via institutional contexts and relational networks



Our focus is more on *isomorphism* (DiMaggio & Powell 1983), which is how the mimicry process of adopting carbonomics institutions diffuses at the country-level structures of climate policies. Two types of isomorphism, *competitive isomorphism* and *institutional isomorphism*, seem to be present. The former rationalises the adoption of zero or low carbon practices which are low-cost and efficient, to maintain competitiveness. The later emphasises the adaptive process of the carbonomics institutional context into the structures and practices of countries' policies. Therefore, the concepts of both competitive and institutional isomorphism are relevant to explain the diffusion process of the carbonomics institution amongst countries.

Depending on the mechanisms employed in adapting carbonomics institutions, three ramifications of institutional isomorphism – *mimetic*, *coercive* and *normative* - can be identified (DiMaggio & Powell 1983; Heugens & Lander 2009). Mimetic isomorphism is a benchmarking process where a country tends to model its carbonomics policies and practices on those of other countries. Coercive isomorphism derives from political influence and the desire for legitimacy. It includes both formal and informal pressures from the stakeholders and society on which a country depends. Such pressures can be perceived either as a force or as persuasion. Normative pressures that drive isomorphic change comes from professional groups or other associations in the carbonomics field which specifically address the conditions and methods of tackling climate change. The pressure is to comply with the norms established by this carbon professionalisation.

Although isomorphism tends to lean towards homogeneity, we hope to establish in this paper that a variety of specifications can still exist depending on the different types of organisation involved (Greenwood et al. 2008). These differences would relate to timing issues. We hypothesise that at earlier stages of carbonomics institution development, a considerable variety of carbon policies will exist. Countries which have started taking actions on climate change, termed *early movers*, may develop many innovations to seek the appropriate

decarbonising policies for their economies. As the field becomes more mature, the degree of similarity in carbonomics policies amongst countries will increase. We believe that a *bandwagon effect* will then emerge from late-adopting countries, after carbonomics institutions have become a form of *taken-for-granted* social behaviour in the global community.

3 GLOBAL CARBON POLICIES: NEGOTIATIONS AND THE CLIMATE CHANGE STRATEGIES

All countries that have ratified the UNFCCC are required to monitor and report their GHGs emissions, and develop programs to tackle climate change. The UNFCCC classified its ratifying countries into two major groups: Annex I countries, consisting of 41 industrialised, developed countries plus economies in transition; and non-Annex I countries, comprising 151 developing countries. According to its 'common but differentiated responsibilities and capabilities' principle, the UNFCCC mandates Annex I countries to take the lead in combating climate change. This principle has been used as a basic guide to construct the burden-sharing for developed and developing countries to clean up global anthropogenic pollution.

The operation of the UNFCCC principle and objective become clearer with the adoption of the Kyoto Protocol in 1997. There are six GHGs listed in the Protocol to be reduced, but the parties are free to abate emissions of one or more of them because the targets are measured in terms of carbon dioxide equivalent (CO_2-e). Two carbon emissions reduction project-based mechanisms include Joint Implementation (JI) by at least two developed countries and a Clean Development Mechanism (CDM) which has to be implemented in the region of developing countries. Both create carbon units called Emissions Reduction Units (ERUs) and Certified Emissions Reductions (CERs), respectively, which can be traded in an emissions trading or a carbon market as the third market mechanism. Emissions trading under the Protocol facilitates Annex I countries to meet their targets of emissions limits and reductions by purchasing carbon units from others.

It is worth noting that the Protocol requires no emissions targets for non-Annex I countries. The exclusion of developing countries from mandatory emissions reduction targets has led to an intense political debate. Large developing countries like Brazil, China, India and Indonesia claimed that the developed countries have polluted the environment for such a long time that they should take the lead in stabilising GHGs concentration in the atmosphere. Developing countries argue that the huge costs to deal with climate change impact were unaffordable in view of their economic development priorities (Bodansky 2001), and that as the developed countries have polluted the environment for such a long time, they should take the lead.

Despite this, there were 41 developed countries and 48 developing countries that put forward their own (voluntary) targets to cut emissions levels by 2020 during COP 16 in 2010. From the lens of institutional theory, these pledges can be seen as widespread affirmation and global acceptance of the carbonomics institution. While these emissions reduction targets are not legally binding for developing countries, they have shown their commitments to join their developed country counterparts to curb global emissions.

With the original Kyoto commitment ending on 31 December 2012, the agreement signed during COP 17 in Durban in December 2011 states that the Protocol was to be extended to have its second period from 1 January 2013 to either 31 December 2017 or 31 December

2020.[1] This future climate agreement, which is planned to come into force in 2020, will legally apply emissions reduction targets for both developed and developing countries. The developed-developing countries agreement to have legal emissions cuts from 2020 represents the worldwide diffusion of climate change-rationalised myths. This global consensus serves as a more solid carbonomics institutional platform to catalytically transform business-as-usual (BAU) routines to carbonomics practices.

4 COUNTRY-LEVEL CARBON POLICY ARCHITECTURES

Both developed and developing countries have applied a wide range of carbonomics policies to control their emissions. An extensive number and range of carbon policy measures have also been implemented and indicate the complexity of the policy environment to decarbonise economies. Using data sourced from the World Resources Institute (2012a); Carbon Finance (2012), Climate Commission (2012), GLOBE (2011), the Productivity Commission (2011) and associated government websites, we summarise in Table 1 the climate- and energy-related policies in heavy polluting developed and developing countries which altogether represent more than three quarters of global emissions.

Clearly, the progress to implement a national carbon regulation differs significantly amongst countries. It is also worth noting that besides these regulated markets, voluntary carbon markets which involve companies that voluntarily purchase carbon credits from clean energy and forestry projects to offset their carbon footprints, transacted 95 $MtCO_2$-e worth US$ 576 million in 2011 (Ecosystem Marketplace 2011). These reports imply that in practice, a carbon market seems to be more favoured than a carbon tax as a worldwide means to put a price on carbon.

We proceed now to examine the carbon policy instruments in the EU, Australia, and China in order to study isomorphic effects. The choice of the European Union (EU) as a unit of analysis was motivated by its record as the first jurisdiction to have a multi-national working system of carbon trading. Thus, it provides lessons that can be drawn from its experience in developing a carbon policy and putting a price on carbon emissions through an ETS. Borrowing the notion from neo-institutional theory, the EU ETS serves as the driver for competitive isomorphism and institutional isomorphism by offering a benchmark in designing carbon policy architecture. Australia was chosen for this study is because it is one of only three countries conferred with an increasing emissions target under the Protocol, as it ranks as the largest GHGs emitting nation per capita among developed countries (Pearse 2010). China has been consistently under the spotlight in the international climate forum for its record of high emissions, largely due to its heavy reliance on coal-sourced energy to fuel its economic boom, China surpassed America as the world's largest polluter in terms of cumulative emissions in 2005 (World Resources Institute 2012a).

[1] Accordingly, all developed Kyoto signifying-countries will continue having mandatory reduction targets, except Russia, Japan, and Canada which had already stated that they would not join the second period of Kyoto commitment.

Table 1 Selected Climate Policies in Major Polluting Countries

Country	Emissions Profile		Carbon Policies			
	% GHGs emission of world total	GHGs emissions per person ($MtCO_2$-e)	Carbon Price	Renewable Energy	Energy Efficiency	Forestry
China*	19.13 %	5.5	P-CM	✓	✓	✓
US	18.29 %	23.4	SN-CM	✓	✓	
EU	13.3 %	10.3	N-CM	✓	✓	
Also in EU:						
Ireland		16.8	Tax			
Netherlands		13.7	Tax			
Finland		13	Tax			
Germany		11.9	-	✓	✓	
Denmark		11.7	Tax			
Norway		10.9	Tax			
UK		10.7	Tax	✓	✓	
Sweden		7.4	Tax			
Russian Federation	5.17 %	13.7		✓	✓	
India*	4.92 %	1.7	N-Tax	✓	✓	
Japan	3.56 %	10.5	SN-CM	✓	✓	
Brazil*	2.68 %	5.4	SN-CM	✓	✓	✓
Canada	1.96 %	22.9	SN-CM	✓	✓	
Mexico*	1.71 %	6.3	P-CM	✓	✓	
Indonesia*	1.54 %	2.7	P-Tax	✓		✓
South Korea*	1.50 %	11.8	P-CM	✓	✓	
Australia	1.47 %	27.3	N-Tax then CM	✓	✓	
South Africa*	1.12 %	9	P-Tax	✓	✓	
Switzerland	0.14 %	7.2	N-Tax			
New Zealand	0.2 %	19.1	N	✓	✓	
Total	76.69%					

Note:
* Non-Annex 1 Countries with no mandatory emissions reduction targets under the Protocol
P Planned nationally
N National
SN Sub National
CM Carbon Market, also known as Emissions Trading Scheme (ETS)
Tax Carbon Tax
All emissions data were sourced from the Climate Analysis Indicators Tool (CAIT) version 8.0.2005 (World Resources Institute 2012b)
All policies data were compiled from Carbon Finance (2012), Climate Commission (2012), GLOBE (GLOBE 2011), and Productivity Commission (2011), updated with associated government websites

4.1 CARBON POLICY ROADMAP IN THE EUROPEAN UNION (EU)

Under the Protocol, which was initially ratified by the 15 Member States (called EU-15), the EU committed to collectively cut emissions levels as a community to 8% below their 1990 levels during the period 2008–2012 (termed the 'EU bubble'), as an addendum to their individual emissions reduction targets as individual EU countries. Each member state was still obliged to achieve its agreed emissions reduction target that was assigned at the time of its Protocol ratification. To meet the Protocol target, the EC has developed around 40 EU-level policies and measures to lessen GHGs emissions, called the European Climate Change Program (ECCP), in addition to the domestic climate policies applied by its member states (Europa 2011).

The design of the EU carbonomics policy commenced with a carbon tax proposal. This was rejected by many member states, most notably the UK, along with intense lobbying from affected businesses in the EU (Wettestad 2005; Pinkse 2007). The carbon tax proposal was replaced by a market mechanism (the EU ETS) to cut emissions levels efficiently (Europa 2008). The EU ETS was launched on 1 January 2005 as a cap-and-trade system covering only carbon dioxide (CO_2) emissions as the major contributor of GHGs causing climate change. The EU ETS involves 27 EU member countries, as well as three members of the European Economic Area: Norway, Iceland and Liechtenstein. It covers around 12,000 factories and plants which collectively accounted for nearly half of the EU's CO_2 emissions. Industry sectors regulated under the EU legislation include the energy sector, iron and steel production and processing, the mineral industry, and the wood pulp, paper and card industry (Europa 2011). These entities' obligations under ETS include monitoring and annually reporting their emissions to the government, and surrendering carbon permits called European Union Allowances (EUAs) or carbon credits called CERS from the Kyoto CDM markets to offset their carbon footprint each year.

The climate policy landscape in the EU charges polluters a carbon price through the ETS and demands renewable energy generation and higher levels of energy efficiency. The EU ETS, which is the primary carbon reducing mechanism, has been delivered in three phases involving a more stringent carbon reduction policy over time. Phase 1 comprised the first three year period from 2005 to 2007, whereas phase 2 coincided with the Kyoto Protocol period, and consisted of a five-year period commencing 1 January 2008. Phase 3 will last for eight years from 2013 to 2020. For phase 1, 95% of the EUAs were allocated free, termed grandfathered, to entities. During the second phase, countries must allocate only 90% of EUAs at no charge and auction the remaining 10%. The scheme was expanded to include aviation emissions from 2012, and will be expanded to cover additional GHGs from industrial sectors (i.e. petrochemicals, ammonia and aluminium). The notable changes to commence in phase 3 include the EU nation-wide cap as opposed to varied caps determined by individual countries, auctioning of carbon permits instead of grandfathering, and the gradually reduced emissions caps for scheme participants over the years (Europa 2011).

These EU climate regulations have been applied in parallel with climate regulations imposed by each member country. Some of the EU member countries have charged a carbon price through taxation as a part of their climate efforts, for instance Denmark (from 1992), Finland (from 1990), Germany (from 2000), Ireland (from 2010), Netherlands (from 1990), Norway (from 1991), Sweden (from 1991) and the United Kingdom (from 2001). These carbon taxes are mainly charged on fossil fuels and/or energy use. A carbon tax is commonly designed to be revenue-neutral as the generated revenues will be returned to the community through tax

credits, rebates and lower corporate and personal income taxes, which is known as a double-dividend effect of a carbon tax by improving the environment while reducing the tax burden on society.

4.2 CARBON POLICY ROADMAP IN AUSTRALIA

The Australian Government ratified the Kyoto Protocol on 3 December 2007 (Franklin et al. 2007), thus committing Australia to cut GHG emissions. Under the Protocol, Australia is one of only six Annex I countries that have not been allowed to cut their emissions during the Kyoto commitment period—Australia was allocated 108% of its 1990 emissions level, Iceland 110%, Norway 101%, and a constant level 100% was allocated to Russia, the Ukraine, and New Zealand (Dawson & Spannagle 2009). However, the Australian Government aims to reduce GHG emissions by 25% on 2000 levels by 2020 (Australian Department of Climate Change and Energy Efficiency 2010).

The Australian Government set out the national landscape of its climate change mitigation policy to move to a clean energy future in a climate plan called Securing a Clean Energy Future (Australian Department of Climate Change and Energy Efficiency 2011b). Similar to the EU Climate and Energy Package, this blueprint for an Australian carbon policy framework relies on pricing carbon as the main market mechanism to cut emissions. This market mechanism is underpinned by a mandatory GHGs reporting system which has been underway since 2008. Other measures to complement this carbon pricing mechanism include renewable energy initiatives, energy efficiency goals and land-use innovation. This last policy initiative which seems not yet to be present in the EU climate plan is to promote land-use activities by curbing emissions through a market-mechanism called the Carbon Farming Initiative (CFI).

Australia has seen an ever-changing and dynamic process in its political arena in installing a nation-wide carbon price. The proposal to put a price on carbon pollution was eventually passed by the Senate on 8 November 2011 (Australian Department of Climate Change and Energy Efficiency 2011b). This Carbon Price Scheme is a hybrid scheme which was designed in two phases. It first charges polluters a progressively increasing fixed price phase for the first three years from 1 July 2012. After this, the price will be determined by the market and the scheme will be linked to the EU ETS. It means that covered Australian entities can use a certain amount of carbon credits from the EU ETS to acquit their liabilities. Because liable entities have to pay a fixed amount of carbon credits which have to be bought from the Government with no ability for future use (that is, they are not bankable and not tradable), the first phase of the scheme operates like a carbon tax.

The Carbon Price Scheme targets around 500 high-polluting entities which together release about 60% of Australia's carbon pollution. The scheme coverage includes all six GHGs emissions from stationary energy (e.g. electricity generators), industrial processes (e.g. aluminium smelting), and fugitive emissions from mining, as well as waste. Although the scheme does not cover emissions from the combustion of transport fuels, the transport sector (e.g. rail, shipping and domestic aviation) will be charged an equivalent carbon price through reduced business fuel tax credits or increased relevant excises. Starting from 1 July 2013, those heavy users of fuels for transportation may choose to use an opt-in scheme option rather than paying a carbon price via such an adjusted fuel tax system. Another exclusion of the scheme is the agriculture and land-use sector, due to the complexity of counting agricultural

emissions. In addition, the combustion from biofuels and biomass is exempted from the scheme. Across liable sectors, entities whose facilities emitting more than 25kt CO2-e and whose certain waste facilities releasing in excess of 10kt CO2-e will fall under the scheme.

Another policy instrument using carbon pricing on land use initiatives, called the Carbon Farming Initiative (CFI), was launched on 1 January 2012. The CFI is a domestic carbon offset scheme which enables farmers, forest growers and land managers to obtain one Australian Carbon Credit Unit (ACCU) for each tonne of CO_2-e gas that is saved from being emitted (i.e. emissions avoidance projects) or is reduced from the atmosphere (i.e. emissions sequestration projects). Any CFI project that meets certain requirements for Australia's obligation under the Kyoto Protocol will be awarded with compliance ACCUs termed Kyoto ACCUs. These compliance-type projects include carbon sequestration through avoided deforestation or carbon avoidance such as savannah fire management and legacy waste landfill. On the other hand, reduced emissions from projects that are not in line with Kyoto requirements such as enhanced soil carbon, revegetation and forest conservation will be conferred with voluntary ACCUs known as Non-Kyoto ACCUs. While the Kyoto ACCUs can be used to satisfy annual liabilities under the Carbon Pricing Mechanism, the Non-Kyoto ACCUs can only be used for voluntary carbon offsets or be traded in voluntary carbon schemes. However, the Government will buy the Non-Kyoto ACCUs through the CFI Non-Kyoto Carbon Fund, amounting to $250 million over a six year period.

In terms of renewable energy generation, Australia uses the Mandatory Renewable Energy Target (RET), which has been under way since April 2001, as the main policy tool to drive renewable energy generation. The establishment of this RET scheme was regarded as the first *mandatory* RET regime across the globe (Kent & Mercer 2006). Initially implemented by the Renewable Energy (Electricity) Act 2000, the RET sought to generate an extra 9,500 gigawatt hours (GWh) of electricity supply in Australia from renewable energy sources annually by 2010 (Hodgkinson & Garner 2008). Approaching the end of this initial RET scheme, in May 2009, the Government announced an expanded RET to account for 20% of renewable energy sources by 2020. This equates to an additional 45,000 GWh of renewable energy generation per year, close to five times that of the previous RET (Australian Government 2011). The RET scheme mandates that wholesale purchasers of electricity (retailers and large energy users) will proportionally contribute to national renewable energy generation. The entities compelled to meet the RET must surrender Renewable Energy Certificates (RECs), each representing 1 MWh of electricity generation from renewable energy (Hodgkinson & Garner 2008).

In general, Australia's carbon policy architecture resembles that of the EU. It uses carbon pricing as the central mechanism, which is enforced in tandem with renewable energy generation. The EU ETS, trading since 2005, appears to have encouraged Australia to implement carbon price mechanism as a means to achieve its emissions reduction at least cost, implying that competitive isomorphism and mimetic isomorphism are apparent in this case.

4.3 CARBON POLICY ROADMAP IN CHINA

While having no mandatory emissions reduction target under the Protocol, during the UN climate meeting in Copenhagen in 2009 China pledged to cut 40% to 45% of its carbon intensity by 2020 on the 2005 baseline level. China's domestic actions to cut down its emissions levels can be traced back to 2005 when it announced its 11th Five-Year Plan of

Economic and Social Development for the period 2005-2010. The emphasis was on improving its energy sector by increasing renewable energy generation and energy efficiency levels, which in turn would curb carbon emissions. In order to promote a better energy mix, China enacted the Renewable Energy Law in 2005, which sought to generate 15% of China's energy from renewable sources by 2020. A series of policies and measures that were developed under this law include a total volume target, a mandatory grid connection, price management regulation, differentiated pricing in the form of feed-in tariffs and favourable taxation for renewable energy. China was ranked as the largest country in the world in terms of renewable energy generation capacity installed in 2011.

China's notable achievement in improving energy efficiency is the closure of inefficient, highly polluting power plants which accounted for a total of 71.4 GW in July 2010, which exceeded the recorded Australian national electricity market generation which was below 50GW in 2009-2010 (Australian Department of Climate Change and Energy Efficiency 2011a). These closed plants were replaced by efficient, cleaner ones, and enabled annual savings of up to 32.6 million tons of coal (Xu et al. 2010). Another initiative for industrial energy efficiency is the Top 1,000 Energy-Consuming Enterprise Program which involves large scale firms in nine main industries (iron and steel, petroleum and petrochemicals, chemicals, electric power generation, non-ferrous metals, coal mining, construction materials, textiles, and pulp and paper). In order to achieve their assigned 2010 energy consumption targets, each of these industries was required to conduct benchmarking, energy audits, development of energy saving plans, information and training workshops and annual reporting of energy consumption. Local authorities periodically monitored the implementation progress by these firms.

In the current 12th Five Year Plan covering the 2011-2015 period which aims at cutting down the intensity of energy use and carbon emissions per unit GDP, China extended this program into The Top 10,000 Enterprise Program to cover more firms with various increased efficiency standards. These firms were required to develop an innovative plan in preparation for a proposed carbon trading mechanism. The Chinese Government has also worked on launching a pilot ETS in five key cities and two provinces in 2013, proposing then to scale them up to establish a nation-wide ETS in 2015 (Carbon Finance 2012). Thus China's roadmap in developing its carbon policy resembles that of Australia. It started by improving its energy sector and then moved into imposing a carbon price in the form of an ETS. Mimetic isomorphism exists in this case. This similar pattern is likely due to the heavy reliance of the two countries on coal to power their economies. However, China has exercised a unique mechanism to ensure its climate policies meet its objectives by allocating its national reduction targets of energy intensity and carbon intensity, including the target of the 10,000 Enterprise Program, to each province. The monitoring system over these carbon policies has been linked to the performance evaluation of provincial governments and their related officials.

5 ISOMORPHISM IN CARBON POLICY AND REGULATION

This paper chose the institutional-theory approach to analyse the development of carbon economies across countries. In general, compelling scientific evidence of climate change appears to have increased countries' awareness of the need to take actions to tackle climate change. Utilising a neo-institutional theory perspective, business-as-usual routines have been increasingly perceived as illegitimate, and have been replaced by a new paradigm of carbon-conscious business (carbonomics) practices designed to achieve a low carbon future. In this

early stage of carbonomics institution development, we have shown that a considerable variation of carbon policy structures will exist amongst countries, although notable isomorphic (similar) regulatory instruments such as an ETS and mechanisms for decarbonising the energy industry will exist. As the field becomes more mature over time, a bandwagon effect will emerge from late-adopting countries, when these favoured policies have become taken-for granted social behaviour.

As can be seen from Table 1, there is much variation in how Kyoto-ratifying countries have transformed their commitments to curb carbon emissions into their domestic policies and practices. While a wide spectrum of climate change regulations exists across countries, a general template of climate policy architecture can be identified. An emissions trading scheme (ETS) or carbon market appears to be favoured as the main market mechanism to curb emissions, and to complement extant energy policies for decarbonising economies. A cleaner energy future, including a carbon-free electricity sector, appears to be a crucial ingredient in shifting to a low carbon future. In addition, mechanisms to address land-use changes and forestry are seen as essential to cut global emissions levels.

However, it was shown that the adoption of an ETS to control emissions is still in various stages of development globally. With the EU as the exception, in many countries ETS is still in the policy stage, or has been passed but is not yet officially operating. The weak design of collecting data of initial emissions levels, setting carbon caps and grandfathering the emissions allowances are notable areas to be improved from the first two phases of the EU ETS. These notable lessons seem to have been incorporated into the design of Australian ETS, called the Carbon Pricing Mechanism. In order to support its future ETS, for instance, Australia has made it mandatory since 2008 for its heavy-polluting entities which will potentially fall under the carbon price scheme to report their emissions levels and energy use. These reported carbon emissions data will be used to set emissions caps for the Australian ETS.

Similar to the EU Climate and Energy Package that relies on the EU ETS as the main tool to control its emissions, Australia set out its upcoming carbon market as the main pillar of its climate policy landscape called the *Clean Energy Legislative Package*. The second phase of the Australian carbon price scheme will be based on a cap-and-trade system which is similar to the EU ETS, and will in fact be linked to the EU ETS. As predicted by neo-institutional theory, Australia has adapted the general design of ETS run by the EU into its future carbon market to cost-effectively drive the shift in moving away from business-as-usual practices. The EU ETS provides a benchmarking template for Australia to model its ETS based on the lessons learned from the EU ETS mechanism design to improve its identified weaknesses and to deliver Australia's carbon pricing mechanism at the least cost. Thus, mimetic isomorphism and competitive isomorphism become apparent in this context. This evidence supports Hilden's (2011) finding that Finland obviously emulated the European solution to use ETS at a domestic level to meet its international obligation under the Protocol in the best possible way.

China's roadmap to apply its carbon policy resembles that of Australia, which can be related to its similar heavy reliance on fossil fuel use. Initially motivated to ensure its energy security, China then began to focus on decarbonising its energy industry sector. Renewable energy generation and improved energy efficiency have been the main priorities. This is similar to Australia, which has targeted a certain capacity of renewable energy since 2001. Australia has expanded its Renewable Energy Target and started its nation-wide carbon price

scheme in 2012. China has started to pilot ETSs in a number of provinces in order to commence a national ETS in 2015.

Another notable progress in carbononomics is the trend to establish bilateral or regional climate partnerships across countries. This partnership is mainly to help advances in the development of carbon markets. Norway has bilateral agreements with Brazil and Indonesia to handle deforestation. The World Bank (2012) launched its Partnership for Market Readiness (PMR) in December 2010 as a platform to transfer financial and technical assistance from contributing countries to develop and set up market mechanisms in implementing country participants. As of October 2012, there were 10 contributing countries and 15 implementing country participants which have been active in the PMR. Australia recently announced that its ETS will be linked to the EU ETS commencing 1 January 2015 (Australian Department of Climate Change and Energy Efficiency 2012). In addition, it has a plan to link its ETS to the New Zealand ETS (Australian Department of Climate Change and Energy Efficiency 2011c). As linking ETSs offers substantial reductions in the cost of cutting emissions levels, Australia has adopted competitive isomorphism in its carbonomics strategy.

Another example of partnership that involves developing countries has been initiated by Japan, which has been working to establish a bilateral offset credit mechanism with nine countries in South East Asia. From a neo-institutional theory perspective, these partnerships also serve as a means of distributing carbonomics institutions amongst participating countries, whereby countries can learn from each other's experience in developing carbon markets. Both mimetic and coercive isomorphism seems to exist within these carbon partnerships. Arguably, more mandatory carbon markets will emerge in national, bilateral or regional levels within the next decade, to complement the planned increase of investments in renewable energy generation and more efficient technologies.

6 CONCLUSION

Emerging carbonomics policies will likely transform the ways many industries conduct their businesses, because carbon policies affect the working of markets and industries. In terms of business perspectives, carbon policies should be recognised for their impact on changing competitive landscapes. Following the suggestion by Thurick and Audretsch (1996), contemporary industrial organisation studies need to incorporate new influences to better understand the dynamics of industrial organisation. Here, countries applying carbon constraint regulations can be viewed as another factor that influences the nature and extent of industry and firm evolution. For instance, these carbonomics regulations could affect barriers to entry, firms' innovations, profits, and the likelihood of survival of firms. It is worth noting that the impact of carbon policies varies across different industries. Highly polluting and energy-intensive industries will bear more carbon compliance costs in comparison to other industries.

This study provides a summary of countries which have implemented carbon regulations, along with their targeted industries, and aims to provide a starting point and encouragement for future research on market conduct and performance to include carbonomics factors and influences in policy analysis. To ignore these developments runs the risk of omitting from the analysis a key new dynamic in market behaviour.

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