Strong, sustainable and inclusive growth in a new era: valuing and investing in China's physical, human, natural and social capital in the 14th plan

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Summary and plan of paper

China's economy has seen rapid development ever since its reform and opening-up strategy was launched in 1978. Strong economic expansion over the last four decades has taken China from low-income to upper-middle-income status.[1] Looking back at the transformation that China has made, however, we must recognise that the old growth story is coming to an end. The phase of development driven by investment in physical capital will become increasingly supplanted by investment in assets such as knowledge and social capital as well as investment in and the preservation of natural capital.

China is entering a new era of development that could transform itself again in the next 30 or 40 years as it drives towards a high-income economy, with well-being, quality and sustainability being at the core of its new strategy. This new transformation must be driven by the technologies and activities of the 21st century, very different from those of the last century.

There is a growing perception that 21st century progress cannot be shaped by 20th century concepts and measured with 20th century statistics.[2] Today, about four out of five dollars spent in the leading OECD economies purchase services or intangible goods. [3] This "dematerialization" complicates our understanding of growth. In addition, the world economic and political structure has changed and continues to change; increasing greenhouse gas (GHG) emissions have put the world at severe risk from climate change; while environmental degradation has threatened health and social stability. In many countries sharply increasing

[1] World Bank classifications.

[2] "Measuring wealth, delivering prosperity", published by Bennett Institute for Public Policy, University of Cambridge on 25 July 2019, https://www.bennettinstitute.cam.ac.uk/media/uploads/files/WER_layout_online_July_2019_final_doubles.pdf

[3] https://data.oecd.org/natincome/value-added-by-activity.htm

shares of wealth and income for the rich have also threatened social cohesion and many have seen falling confidence and trust in social and political institutions.

New forms of growth can and should be sustainable. Sustainability means offering the next generation opportunities at least as good as those available to the current generation, assuming they behave similarly to generations that follow them. The emphasis on sustainability reflects the fragility of future development and growth in the face of both the immense risks of climate change and environmental damage, and it reflects the pressing needs to improve standards-of-living for the Chinese people, especially the poorest.

The opportunities for future generations are determined by the assets they inherit from current generations, in particular physical, human, natural and social capital. Thus the future will well-being of China's people will in large measure be shaped by these assets. In this context, this study builds a research framework where four types of capital, physical, human, social, and natural capital are at centre stage. And China's new development must both recognise the deterioration in natural capital and problems around social capital. It must also take careful account of how the world has changed, including China's very large role in the world economy and problems around international trade and investment.

China's development strategy will have a profound effect on the rest of the world, particularly the Belt and Road Initiative (BRI) countries, but also the poorest nations via the climate implications. Thus the 14th plan, together with the BRI, is fundamental to the future of China and the world.

The new investment and innovation opportunities for sustainable and inclusive growth are immense. Strong investment in all four of the capitals will be crucial but they will be investment with high returns. It is crucial to put in place the strategic policies that can grasp and make the most of these opportunities. Investing in sustainable and inclusive growth is the right response to a faltering growth rate. Reverting to a narrow focus on physical capital and the technologies of the last century would be a grave mistake.

The paper will set out the new growth strategy in broad terms and then, within that strategy, examine the role of investment in the different types of capital. Thus we examine:

i) the concept of each type of capital and its relation to growth and well-being;
ii) how the different types of capital might be measured using Chinese data;
iii) strategies for accelerating investment to achieve high productivity and sustainable growth.

In so doing we hope to offer an approach to growth and development in China which could help understand a new development strategy for China in the 21st century. This is not a story

of some long-run model of growth. It is a plan for a transformation in the next 2 or 3 decades in a changing world. We argue that an attempt at high-carbon growth over the medium or long-term is not a feasible option. It would create an environment so hostile that it would likely reverse development and lead to decline or collapse. Even before this, China would lose competitive advantage in deploying and developing the new resource-efficient technologies on which the world will increasingly depend. And it could perpetuate or aggravate the very serious problems of air, water and soil pollution.

Rapidly declining costs of clean alternatives to fossil-fuel energy sources and increasingly stringent climate and energy policies across the globe, intensify the risks of economic dislocation and 'stranded assets' (Campiglio et al., 2018). Lewis (2014) estimates that implementation of policies for a 2˚C scenario could cause the fossil-fuel industry to lose of the order of US $30 trillion in revenues over two decades. Much primary fossil fuel resource as well as upstream fossil fuel related infrastructure (including wells, mines, ports, refineries and power stations) will need to be retired early or stranded (McGlade and Ekins 2015, Pfeiffer et al 2016). China can reshape its economy to be resilient to, and profit from, such changes.

Further, the new approach to growth can provide strong innovation, investment and growth in the short to medium term including many productive job opportunities, and lay the foundation for very attractive, inclusive and sustainable growth over the coming decades. In this paper, building on the ideas in Hepburn and Stern (2018), we try to provide the beginnings of an analytical framework for key elements of this new growth story.

The plan of the paper is as follows. In the first section we examine the conceptual framework for a new growth story. This will involve fundamental structural change towards higher tech, higher skills, more service sector opportunities, and include structural change, the role of artificial intelligence (AI) and robotics, automation and the recasting of cities. The strategy will be built on and driven by investment in the four types of capital. In section two we set out the issues around concept and measurement, and in section three some of the opportunities for investment in the four capitals. In section four, we draw the strands together in terms of the 14th plan and structural and technological change in the context of a changing world economy, including the BRI.

1. China's new growth story

1.1 The next stage of China's development: a new strategy for a new era

China has always looked ahead to chart the next stage of reforms as the economy and technology advance, challenges appear, and as the world changes. (Hepburn and Stern 2018)

argued that this next set of reforms is of special significance, not only for China but also the world.

The growth story of the coming decades progresses beyond the standard economic models in which growth is shaped largely by physical capital. That approach reflected the Harrod-Domar idea that the growth rate is the investment rate divided by the incremental capital-output ratio (Harrod, 1939, Domar, 1946). The growth story in the 21st century, if it is to be sustainable and capable of prospering in a changing world, must be based on a balanced and complementary accumulation of several forms of capital. In terms of outcomes, China will likely focus on well-being, broadly understood, rather than narrowly on output, and, in achieving the broader goals, emphasise higher productivity and resource efficiency. High tech, high skill and service sector activities will play an increasing role.

China, with its size, history and prospects, is inevitably a leader on the global stage, on many dimensions. As currently the world's largest emitter of greenhouse gases, and a country very vulnerable to climate change, action on climate change is inevitably one of those dimensions. The world's infrastructure will likely double in around 15-20 years, much of it associated with urban expansions, and a large part of that increase will be in China. If this new additional world economy or infrastructure looks anything like the old, then cutting emissions in the next two decades absolutely by more than 40%, necessary for holding to 2°C, would be impossible (and the absolute cuts for 1.5°C would need to be much larger). Hence there is an urgent need for radical change.

The belief that the world must shift to a low-carbon future is already prompting accelerating investment in clean technologies such as renewables and electric vehicles (EVs), lowering their costs and, as they outcompete fossil fuels, helping make the belief self-fulfilling (van der Meijden and Smulders, 2017). Acemoglu et al (2012) describe how the "clean innovation machine" once "switched on and is running" can be more innovative and productive than the conventional high-carbon alternative, with knowledge spill-overs generated along the way benefitting the whole economy (Dechezleprêtre et al, 2014). China is already playing a major role in this global revolution. And it will continue to drive and benefit from that revolution, provided it continues to innovate and invest in the assets that will take forward that revolution and underly its future prosperity.

1.2 Opportunities from starting early and planning strategically

The evidence shows that it pays to start early when managing such a large-scale structural transition. Locking into high-carbon infrastructure, institutions and behaviours will make it costly for China to retrofit and replace these assets later when they become devalued. China

will have missed the opportunity to position itself as a world leader in a changing global economy.

By contrast, investing in the technologies and infrastructures of the future is likely to prove highly profitable. Hidalgo et al. (2007) and Mealy and Teytelboym (2017) used network analysis to demonstrate that it is easier for countries to become competitive in new green products the closer they are to similar production capabilities and know-how in existing sectors. As a result, green transitions are highly path-dependent: countries which successfully invest early in green capabilities have greater success in diversifying into future green product markets. This reinforced the findings of Aghion et al. (2012) who provide empirical evidence that a firm's choice whether to innovate clean or dirty is influenced by the practice of the countries where its researchers/inventors are located and that firms tend to direct innovation toward what they are already good at.

The assets China invests in now will shape fundamentally the direction and success of the country's development. Given that sustainable growth and well-being depend on the four types of capital, physical, human, natural and social capital (Stern, 2015, chapter 6.4; Hamilton and Hepburn, 2017; Managi and Kumar, 2018; Lange et al., 2018), investing in and achieving high productivity of these capitals should be at the core of China's growth and development strategy for the new era.

The investment China must make in these assets will generate strong benefits, even in the short term. There is growing appreciation of the opportunities associated with a low-carbon transition (Hale, 2018). Rapid reductions in renewable energy costs have already challenged long-held notions about the cost of sustainable growth (Trancik, 2014). These include not only commercial opportunities associated with deploying (and fabricating and exporting) cheap and increasingly competitive new clean technologies, but also benefits from reductions in waste and inefficiency, improved energy security, reduced particulate pollution, and reduced congestion from clean compact cities. These are all very powerful benefits, and they are over and above the fundamental benefits of the reduction of the huge risks from unmanaged climate change.

More recently, a number of authoritative studies have shown that many or most of the policies required to decarbonise the global economy will boost short-term growth by addressing multiple market failures. For instance, Hallegatte et al. (2012) argue that compared with business-as-usual, green growth would mean immediate positive effects on the economy, such as co-benefits (e.g. reduced local pollution), growth in new 'green' sectors, and less energy price volatility via reduced dependence on fossil fuel imports. The New Climate Economy (NCE) released its initial report in September 2014 (Stern, N. and F. Calderon, 2014),

suggesting that more than half and as much as 90% of the global emissions reductions required to meet an ambitious climate target could generate net benefits to the economy beyond those of emissions reduction. Innovation not only drives productivity and growth it also helps us to get more out of the resources we have by boosting efficiency.

In the next phase of China's development, natural capital and social capital will become central objectives of economic policy. China has already emphasised the importance of 'ecocivilisation' (Naustdalslid, 2014), taken action against air, water and land pollution, increased forest cover, and is moving to curb GHG emissions towards net zero. China recognises the importance of social capital and a cohesive society, tackling inequality, and of taking action to promote good governance (Liu, 2017; Shigong, 2018). China has for long invested, through health and education, in the human capital of its people. This new growth strategy will not only be clean but also inclusive.

These investments in social and human capital imply that the strategy must embrace a world which is changing very rapidly. Future technological change, with AI and automation (Adams, 2018) digitisation and robotics in particular, as well as the challenges of climate change (IPCC, 2018), is likely to transform investment, work, consumption and the functioning of cities. It will stretch across all sectors, including services as well as manufacturing. This requires flexible and responsive institutions able to shift resources and investments towards activities and assets which will be fit for and resilient to a changing future. Carbon- and resource-intensive assets are likely to play a diminishing role in the economy of the future.

Correspondingly, China is shifting the balance of its economy towards higher-technology knowledge-based services. Innovation and dematerialisation will increasingly drive productivity growth in China, extracting more value out of fewer resources. Digital technologies and innovations have the potential to radically increase real-time connectivity and efficiency. A highly skilled labour force is necessary for adopting such frontier technologies; thus there is a close connection between human capital and structural change and the new investment in physical capital.

Rapid transformative change, whether from decarbonisation or AI, automation, and digitisation, needs to be managed carefully. The gains must be, and be seen to be, equitably distributed, and new opportunities available to all, if social harmony is to be preserved and the political economy is not to inhibit progress. This requires investments in people and places, as well as safety nets. It will also require:

- Enabling institutions and policies to reskill, retool, and enable affected workers to take new opportunities or activities;

- Targeted ‘place-based’ employment transition policies in areas at high risk of disruption, drawing on lessons from across the world (see Austin et al. 2018);
- Policies designed to compensate those who lose out.

The adjustment costs associated with such a transition are real, but with the right policies they are manageable. Economic history shows that economies which embrace change, invest in a diverse range of flexible assets and which do not inhibit the flow of resources from declining, low-productivity sectors to new, more productive sectors, are better able to manage structural transformations. Over the longer term, education systems should from the beginning, try to empower people to embrace change and learning should be seen as life-long.

1.3 The four complementary capitals

China’s future prosperity depends on preserving and investing in the four fundamental assets which drive sustainable development and foster wellbeing. As the next two sections will show, the value of all assets is a function of their interaction with each other. This points to the need for balanced investment noting that these four types of capital are complimentary. Investment in physical capital and technologies, including utilising and adopting AI, involves complementarities between human capital and knowledge capital (the ideas we all build on). Romer (1990) showed through the development of endogenous growth theory how increasing returns to ideas and discovery can overcome the diminishing returns to factors like labour and capital, generating resources for further investment. Investing in mobile or wired computers induces smart ideas on how to use them. This enhances the returns to developing new software and algorithms which further increases the returns from and value of hardware.

Investment in human capital can improve individual health, life expectancy and build trust in communities and institutions so boosting social capital. This improves productivity and enables investment in physical capital, training and governance, including improved environmental stewardship. By contrast, declining or depleted natural capital, including pollution, can undermine human health and wellbeing working in the opposite direction. Floods and natural catastrophes borne of environmental stress, impaired access to water and a changing climate can destroy and disable physical assets and prompt social dislocation including conflict and migration. Degraded social capital undermines the ability of human capital to generate new ideas regardless of how well-educated or trained people are and how well equipped their workplaces. These assets are complementary, must be valued together, and investment in them must take account of their interactions. Access to all four forms of

capital form the basis of Amartya Sen's idea of "capability" or "the ability to pursue a life one has reason to value" (Sen 1993 and 1999).

Greater quality and quantity of investment in the four capitals can be delivered through a partnership of strong government and an innovative private sector. Wise investments in the different capitals are mutually supportive, achieving multiple goals simultaneously; for example, extensive, clean and efficient public transport can enhance all four capitals and thus help deliver more inclusive, cleaner and higher-quality well-being and growth. Some forms of renewable natural capital such as biodiverse and healthy ecosystems, forests, fish stocks and a stable climate are prone to thresholds and systemic collapse when depleted. The collapse of such critical natural capital can undermine the other three forms of capital. At the same time some sustainability can be possible – air conditioners can soften the blow of global warming although investing in them and using them can further increase warming.

It is clear that uncertainty and complexity in measurement are an innate feature of measuring wealth. Unlike goods and services, which are current flows, the value of capital stocks now depends on the value of expected future benefits they generate. This can make the valuation of wealth both uncertain and volatile. The morning after a stock market crash, the factories, land and labour which generate output have not disappeared, but the expectation of their ability to generate benefits in the future has diminished.[4] This applies to all forms of capital from fixed property to good ideas, Measurement challenges do not diminish the importance of valuing the assets that matter, but they do point to the importance of investing in metrics and statistics to help inform valuations.

1.4 Innovation in technologies requires innovation in institutions

Both the environment and inequality have many dimensions, including air in cities, forests, rivers and oceans in the former, and gender, generational and regional in the latter. In a rapidly changing world, the potential dislocation arising from new technologies, and pressures from an aging population all point to the importance of managing change and insecurity. All of these lead us to the centrality of sustainability in objectives and a recognition that innovation and change will be fundamental to sustainability.

(Romer 2010) pointed out that innovation which drives endogenous growth is not limited to technological capital and knowledge capital; it also applies to rules, governance, and policies, all of which drive productivity. He argues that social rules often hold back the potential

[4] See for example, Zenghelis 2019 'The future matters, so discount it with care'. https://www.lombardodier.com/contents/corporate-news/responsible-capital/2019/august/the-future-matters-so-discount-i.html

introduction and exploitation of new technology. Indeed, new technologies are potentially harmful if not accompanied by rules that make growth sustainable – for example, rules that limit pollution, soil degradation, and overfishing; or rules that regulate economic rent-seeking from innovation via patents or market power, which can increase inequality and inhibit further change, if managed badly.

These pressures have also motivated increased emphasis in the 14th plan on the key elements of well-being as the economic and societal objectives, rather than the narrow goal of output or income. These objectives, embodying a broader view of development than in the past, are broadly speaking the dimensions of the Sustainable Development Goals (SDGs) agreed by the world in September 2015 (United Nations Development Programme, 2015). Driving innovation in institutions equipped to guide China through the challenges and opportunities of the coming decades will be as important as driving innovations in technology. Sustainable infrastructure, well-functioning cities and good governance will be vital. Good governance also means that reforms should engage private individuals and civil society and be market-oriented in ways that encourage initiative and creativity.

We argue in this paper that this new approach to investment in multiple forms of capital can be structured in ways that are inclusive, reduce inequality and promote social cohesion. For example, public transport will benefit poorer sections of the community particularly, since they are much more dependent on this transport, including in facilitating access to employment. Air and water pollution tends to do greater harm to poorer people. Looking ahead, the population will age with corresponding pressures on public finances and health systems making the need to invest in assets for the future all the more pressing. The next section outlines the concept, measurement and valuation of the four capitals before seeking to examine opportunities for sustainable investment.

2. Concept and measurement of the four capitals

2.1 Physical capital

Physical capital has long been recognised as a central factor driving economic growth. Indeed, as we saw in the previous section many models of the first half and of the last century regarded it as the central factor. For the classical economists including Smith, Ricardo and Marx, it was with labour and land, one of the three primary factors of production. Physical capital mainly refers to tangible capital goods which are used to produce a product or service, including such as machinery, equipment, factories, buildings, transportation facilities and so on, underpinning the functioning of production processes and modern societies. Some types of physical capital are directly involved in the process of creating a product or service that is sold such as the

power generating equipment that produces electricity. Others are less directly involved, although nonetheless crucial, such as the computers in the offices of an insurance company.

In the past the concept of capital as physical quantity which shapes other things in an economy has itself been controversial. If capital is aggregated across different components then the aggregation will depend on prices. Marx, and subsequent Marxism economists such as Sraffa and Robinson (Sraffa, 1960; Robinson, 1956) argued that the capitalist system distorts prices of goods away from their value in terms of labour and that this, in turn makes the value of capital endogenous and not simply physical. Those issues are not our concern here.

Several estimation procedures can be considered for the calculation of physical capital stocks. Some of them, such as the derivation of capital stocks from insurance values or accounting values or from direct surveys, are very intensive in resources and face problems of limited availability and adequacy of data. Other estimation procedures, such as accumulation methods and, in particular, the Perpetual Inventory Method (PIM), are (relatively) cheaper and more easily implemented because they require only investment data and information on the assets' service lives and depreciation patterns. These methods derive capital series from the accumulation of investment series and are the most popular.

Simon Kuznets was the pioneer, in the 1920s and 1930s, of the compilation of data on output and capital. He was well aware of the early work and modelling of Russian economists on investment, capital, growth and cycles. PIM builds on his work. It is the method adopted by most OECD countries that estimate capital stocks (Bohm et al. 2002; Mas, Perez et al. 2000; Ward 1976). An important early account is Goldsmith (1951).

In China, a number of studies have estimated the stock of physical capital based on the PIM, such as Hongye and Feng (2005) who argue that the availability of data has limited research work in estimating China's capital stock using these methods. Huang, Ren et al. (2002) estimated China's capital stock in the manufacturing industry by sectors over 1980-1995; Zhang, J. (2008) recommended a standardized procedure in constructing the level of China's provincial capital stock using PIM from 1952 to 2004.

2.2 Human capital

The concept of human capital has been widely recognized since Schultz (1961), who defined human capital in terms of the "skills and knowledge acquired". Though a variety of definitions have been made, in general most of them lay emphasis on definitions that focus on skills and knowledge related to the economic returns of investment in human capital. For decades, literature analysing the role of human capital in economic growth proxied human capital with the measurement of education or years of schooling, examples include Nelson and Phelps

(1966), Barro (1991), Barro (2001), etc. Nevertheless, as broader non-economic benefits delivered by human capital investment become apparent, such as improved personal health and well-being, OECD (1998) extended the definition of human capital. Following definitions made by OECD (1998), OECD (2001), (Hamilton 2006) and many others, human capital can be captured as the stock of knowledge, skills, experience, competencies and attributes (e.g. health) that an individual accumulates throughout her or his life, which can then be applied in the economy through the increase of an individual's productive capacity. This broader view uses the concept of human capital not only as a factor that influences economic growth, but also one that contributes to well-being. It is an example of something that is both an objective (education, health and agency have value in themselves) and also an instrument or factor influencing other objectives, such as output or income.

A number of methods have been used for the measurement of human capital: cost-based, income-based, indicators-based and "residual". See the "*Guide on Measuring Human Capital*" published by United Nations Economic Commission for Europe (UNECE). Each method has its advantages and drawbacks, for more details see UNECE (2016).

The World Bank adopted the residual approach[5] in its 2006 report "*Where is the Wealth of Nations?*" (Hamilton 2006), they subsequently extended their estimating framework in the 2011 report "*The Changing Wealth of Nations: Measuring sustainable development in the new millennium*"(Jarvis, M., et al. 2011).However, World Bank does not use this approach anymore; see its latest report "*The Changing Wealth of Nations 2018: Building a Sustainable Future*" (Lange, G.-M., et al. 2018).

In their 2019 publication the World Bank launched a Human Capital Project (HCP) and released a cross-country human capital measurement metric called the Human Capital Index (HCI) (World Bank, 2019). Similar indicator-based approaches also appeared from the World Economic Forum (2017), which adopted the Global Human Capital Index (GHCI) to provide a holistic assessment of a country's human capital stock. However, these standard indicator-based approaches applied to all nations are mostly quite general and often, and inevitably, simplistic.

Jorgenson and collaborators (see e.g. Jorgenson and Pachon, 1983 and Jorgenson and Fraumeni, 1992a and 1992b) have proposed a method based on lifetime income which has been adopted by a number of countries. However, as mentioned by (Li, Liu et al. 2014), the

[5] The residual approach takes the discounted value of the future consumption flows, and subtracts from this amount a "contribution" from the monetary value of those capital goods for which monetary estimates of their current stocks are readily available. The residual is attributed to other effects, including human capital, but it is clear that it is hard to disentangle from other efforts.

standard J-F method cannot be applied to China due to data availability. In fact, there has been no comprehensive measure of human capital in China due to the technical difficulty in measuring the components of human capital (knowledge, skill, competencies and attributes) and the lack of data in China (Li, Liang et al. 2013).

(Li, Liu et al. 2014) modified the standard J-F by incorporating the Mincer model into the J-F framework to overcome the paucity of earnings data in China and provided a measurement of human capital in provincial level over 1985 to 2010. One possibility for subsequent work is to extend the analysis to more recent years, and consider breakdowns into urban-rural or by province.

2.3 Natural capital

Natural capital refers to the stock of natural assets which include key dimensions of soil, air, water and all living things. They can be identified and valued in this context by the range of services, often called ecosystem services, which are generated by these natural assets and which affect what is possible to do, the quality of life and indeed the possibility of human life. Further, they have direct value in terms of the enjoyment and sense of fulfilment by people arising from the existence of these assets.

Interest in the concept of natural capital has expanded rapidly in recent years. And programmes and institutions have been established to value them. For example, the Natural Capital Committee (2014), suggested that natural capital can be defined as the elements of nature that directly or indirectly produce value to people, including ecosystems, species, fresh water, land, minerals, the air, and oceans, as well as natural processes and functions. Most reasonable definitions of natural capital would include renewable resources such as forests, fish stocks, functioning ecosystems (including oceans) and a stable climate. They would include exhaustible resources, such as copper, tin or iron. Natural capital is often poorly managed around the world, leading to damages to ecosystems, loss of species, excessive pollution and premature deaths, reducing overall productivity and well-being.

Unlike physical and human capital, natural capital is generally in decline, often with damaging consequences. This has led, over the last three or four decades to a growing recognition of its importance. The United Nations Statistical Department, for example, oversaw the production of the System of Environmental Economic Accounts (SEEA) in 1993, and then subsequently revised and strengthened it, most recently in 2012 (United Nations Statistical Department 2017).

Following the SEEA framework, several standard sources on natural capital measurement have been developed, such as World Bank (*Changing Wealth of Nations 2018*) and United

Nations Environment Programme (UNEP) (*Inclusive Wealth Report 2018*), as well as some on-going projects such as the Stanford Natural Capital project[6] led by Gretchen Daily and Steve Polasky, and the SEEA experimental ecosystem accounting[7]. The central framework of the SEEA is an official statistical standard on the values of ecosystem services across countries. Data are, however, very limited.

In China, the project of Natural Capital Accounting and Valuation of Ecosystem Services-China started in December 2017. It is developing accounts with monetary estimates for six ecosystem categories including forests, farmland, grassland, freshwater, marine and urban in two of China's provinces: Guangxi and the Guizhou.[8] China has also completed its first national ecosystem assessment in 2014, spanning 2000-2010, with the main findings published in "*Science*" (Ouyang, Zheng et al. 2016). Further work could build on these beginnings.

2.4 Social capital

Coleman (1988 and 1994) has argued that social capital can be perceived and defined on the basis of "social theory, and from the broad idea that social relationships are resources that help people act effectively". The World Bank held a workshop to discuss a range of observations under the concept of social capital in 1997,[9] and later released the report of "*Social capital: a multifaceted perspective"* (Serageldin and Dasgupta 2001), presenting theoretical and empirical studies of social capital written by leading sociologists, economists, and political scientists which further explored the concept. Putnam (2000) described social capital as consisting of cognitive and structural elements, and emphasised connections within and among social networks. Bourdieu (1986) and Lin (2002) also stressed the network perspective, and described social capital as a kind of resource nested in social network.[10]

The nature of social capital and its future benefits are particularly hard to pin down. But no matter how it is defined, the underlying idea is that social networks and structures have value. Social capital is often referred to as the glue that holds societies together. It relates to generalised trust, shared rules, and the social norms and values that shape the ways we behave in everyday relationships and transactions (Bennett Institute for Public Policy, 2019).

[6] https://naturalcapitalproject.stanford.edu/
[7] https://seea.un.org/ecosystem-accounting
[8] https://seea.un.org/content/natural-capital-accounting-and-valuation-ecosystem-services-china
[9] https://archivesholdings.worldbank.org/social-capital-integrating-economists-and-sociologists-perspectives-1v
[10] See also Arrow (2000).

A key outcome flowing from social capital is civic engagement, collaboration and interaction (including formal mechanisms for trading goods, services capital and labour).

The difficulties in pinning down the concept have led, some have argued, to over-versatility and indiscriminate application (Lynch, Due et al. 2000). Nardone, Sisto et al. (2010) argued that most empirical studies measure it through indirect indicators (such as membership of organizations and voter turnout) mainly related to the outcome of social capital rather than its core components. The inevitable multi-dimensionality and complex dynamics of social capital over time makes building a measurement framework very difficult (Woolcock and Narayan 2000).

Forrest and Kearns (2001) decomposed the concept into several core components including common values and a civic culture, social order and social control, social solidarity and reductions in wealth disparities, social networks, and place attachment, and illustrated how these components can be operationalised for policy action. Similar work had also been done by Nahapiet and Ghoshal (1998) who systematized the domains of social capital into three dimensions: structural, which allows interaction among individuals; relational, which produces interaction among the individuals as a result of long-lasting relationships (e.g. trust, governance mechanism), and cognitive which refers to elements of social organization (values, beliefs, etc.) that allow individuals belonging to a group to reach a shared vision of their own community.

Following the decomposition of social capital by Nahapiet and Ghoshal (1998), Nardone, Sisto et al. (2010) applied six indexes to measure these three dimensions of social capital. Teilmann (2012) built a social capital index based on four indicators: number of ties, bridging social capital, recognition, and diversity.

Based on previous literature, one possibility for future work is in statistical analyses based on social surveys in China to construct a small number of principal components that could "explain" a latent concept of social capital. The approach of the Bennett Institute for Public Policy (2019) and the design process and data from the European Social Survey,[11] based on a few core components such as trust, civic engagement and effective institutions, might be a useful guide for statistical analyses in China. Whether or not this is possible or helpful depends entirely on the data either already available or within scope for development.

[11] https://www.europeansocialsurvey.org/

3. Investment opportunities in the four capitals

We have argued that investment in the four key capitals should be at centre stage in the 14th plan. In this section we describe some key opportunities. The list is not intended to be exhaustive but to illustrate a coherent strategy for the new era, which takes into account both the importance of investing in all four capitals and some of the complementarities and interconnections.

The dangers from low-quality physical capital to the other three types of capital have been increasingly understood: polluting physical capital damages natural capital, which undermines human health, reducing the productivity of human capital, which in turn can undermine social capital. On the other hand, poor social or human capital can also distort or deter investment and lead to low-quality physical capital. If China is to achieve strong, sustainable and inclusive growth in the new era it is clear that investment in the four capitals must be carefully integrated.

3.1 Physical capital

Physical capital includes infrastructure, buildings, machinery, and so on (Hamilton and Hepburn, 2014). We focus here on infrastructure. Infrastructure delivers the basic facilities and structures needed for the operation of an economy and society. It includes power, heating, transport, water, sanitation and communication and internet connectivity. Infrastructure is at the heart of the achievement of sustainable development, including health, economic growth and environment. Sustainable infrastructure is at the core of the SDGs, and, as Bhattacharya et al. (2016) show, investment in any one form of infrastructure will usually both enhance other forms of infrastructure and help delivery on a number of the SDGs.

1) **Investment in low-carbon and resilient infrastructure for more productive, more attractive and healthier cities**

Infrastructure investments which are low-carbon and resilient have many benefits beyond the fundamental contributions of mitigation and adaptation in relation to climate change.

Reliable, clean power networks reduce pollution and improve competitiveness. Cleaner ways of heating and cooling can benefit all; Chen, et al. (2013) estimated that coal-based winter heating in China cut life expectancy in northern China by over five years in the period 1981-2000. Better urban public transport reduces congestion and air pollution, with large economic and health impacts, particularly for poor people.

As Stern and Zenghelis (2018) argued, investment in improved strategies for future urbanisation towards compact, connected and coordinated cities, can deliver great benefits

both in terms of sustainability and resilience and in terms of much more attractive cities with: functionally and socially mixed neighbourhoods; a high level of public service; and efficient public transport networks. Overall, they would offer China a much more attractive future than the urban sprawl that is developing in many cities. See also "Climate Emergency, Urban Opportunity", CUT, September 2019[12].

It is estimated that globally compact, connected, and coordinated cities could provide up to US$17 trillion in economic savings by 2050, stimulate economic growth by improving access to jobs and housing, while also strengthening resilience to physical climate risks and delivering up to 3.7 gigatonnes per year of CO_2 savings over the next 15 years (World Resources Institute, 2017).

Unlocking the power of cities to deliver clean economic development is not merely about pricing reforms and fostering new markets, but requires planning of compact, connected and coordinated use of urban land. China alone could reduce infrastructure spending by up to US$1.4 trillion by pursuing more compact, connected urban growth (World Bank, 2014). Functionally and socially mixed neighbourhoods with access to green spaces, comfortable, affordable, and climate-smart housing for all, and efficient public transport networks could both protect natural capital and provide a basis for higher quality, stronger and more sustainable economic growth.

2) Investment in infrastructure which could increase energy efficiency in industry

Upgrading industrial processes can significantly increase efficiency, reduce waste and lower production costs, especially in transitioning and developing countries. The UN Industrial Development Organisation (UNIDO) has estimated that implementing best industrial technologies could reduce energy intensity worldwide by as much as 26% in the next 25 years, triggering a 32% reduction in global C02 emissions from the energy system as a whole (New Climate Economy, 2018). China's experience demonstrates that improving energy efficiency in industries can deliver substantial savings: during the first four years of the 12th five-year plan energy productivity increased significantly across a number of key sectors delivering an estimated US$18 billion economy-wide annual energy cost savings (IEA, 2016).

3) Investment in infrastructure encouraging energy transition

In its current plans China aims to raise its non-fossil fuels share to 15 per cent of the national energy mix by 2020. China has already strongly and successfully invested in solar photovoltaic (PV) power: according to the China National Energy Administration, by the end of 2016, the

[12] https://www.globalcovenantofmayors.org/wp-content/uploads/2019/09/Climate-Emergency-Urban-Opportunity-report.pdf

total installed capacity of PV power generation in China reached 77 GW. Powerful future growth is anticipated; China has become the world's largest producer of solar cells surpassing Europe and Japan (Shuai et al. 2018). Shuai et al. (2018) urge that China should continue support for developing stronger solar PV industry, and encouraging more technological innovation to further enhance the international competitiveness of its products. Now is the time for China to accelerate investment in the infrastructure of the future, and to create strong economic resilience and a healthier, cleaner and more productive and sustainable economy. This will form part of China's strategic evolution in its comparative advantage towards becoming a global knowledge and innovation hub for developing, producing and exporting new clean technologies in one of the fastest growing global markets (Song and Wang 2018).

Actual or expected changes in policy, technology and physical risks – as well as the threat of litigation for loss and damage from climate change – could prompt a rapid reassessment of the value of a large range of assets as changing costs and opportunities become apparent (Stern and Zenghelis 2016). It is important to signal future changes now, include them in the 14th Plan, and plan the process of transition carefully. As we argued in section 1, the process of change to the zero-carbon economy is path dependent and early clarity will enable it to move much better than hesitation or delay.

4) Investment towards a green BRI

China's investment strategy for the new era will both shape and be influenced by China's relationship with the world. Its new trade and investment strategy, with higher tech and services internally and more low-cost manufacturing externally, is clearly interwoven with the BRI. China's partnerships with BRI countries will be of fundamental importance to both China and the world. Infrastructure for connectivity is vital for fostering trade; so, too, is productive capacity elsewhere. A wider and more decentralised set of strategic partnerships, will lead to more resilience for the Chinese economy as well as providing the strong productivity gains that trade can offer.

It is the BRI countries themselves which will decide their own future and their strategies for investment and connectivity. Thus China's BRI strategy and investments will have to be developed as partnerships and take careful account of politics and priorities in the BRI countries.

Sustainability of BRI investments is vital to all countries of the world, including, of course, China and the BRI countries themselves. The population of BRI countries represents around three times that of China, with income per capita around half of China now. Two decades from now their economies may have income per capita equal to that of China now. If at that time their future emissions per capita look like China now, the world would be adding tens of billions

of tonnes of emissions per annum when in that period emissions must fall very sharply if we are to achieve the Paris targets. The damage to the world's future climate would be immense and irreversible. A green BRI is of fundamental importance to the future of the world.

3.2 Human capital

China needs a highly skilled, healthy, flexible labour force to tackle the challenges and changes of the coming decades. It will be a period of very rapid change with the move to high tech and services, increased urbanisation, AI and robotics, an ageing population and changing world order. It must invest strongly and wisely in human capital. Based on the concepts described above, Figure 1 offers a description of core elements of human capital, together with the investments that can enhance human capital and the outcomes that can flow from them.

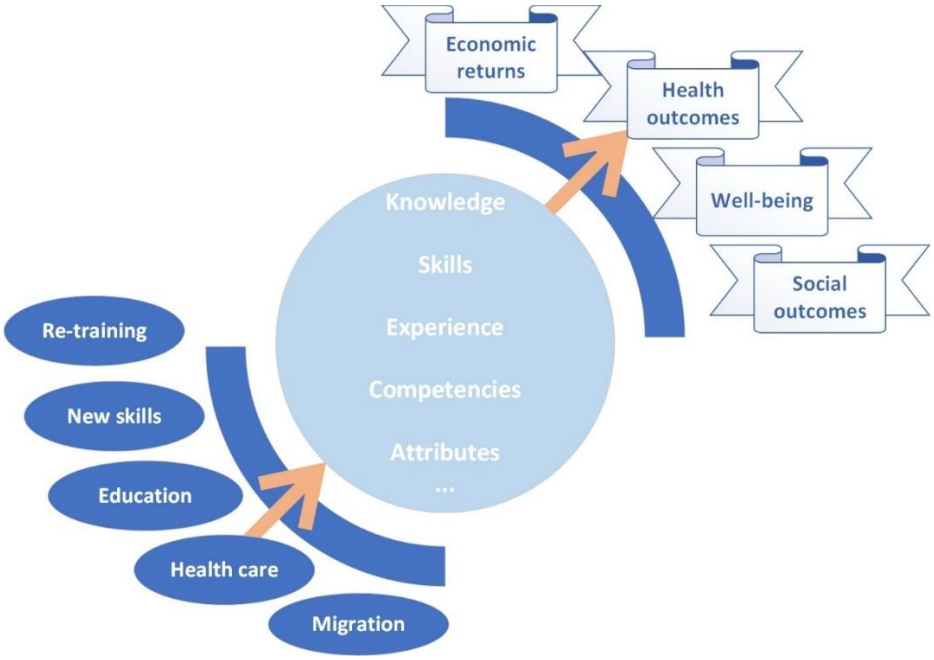

Fig. 1 Investment in human capital and the benefits

These investments should take account not only of the necessary new skills for new types of investment but also the management of change in a just way, "the just transition", so that those who work in activities that will be restructured or decline, have a chance to participate in the new economy. These issues are taken up under social capital below.

1) Skills necessary for cleaner infrastructure

As it urbanises and moves towards higher-quality and sustainable growth, China will require strong investment in new types of sustainable infrastructure. These include High-Voltage

Direct Current interconnectors (HVDC), charging point for EVs, re-fuelling for hydrogen trucks and ships, overhead wiring on major roads for long-distance electric trucks, further investment in PV and batteries. As a consequence, the skills that are required in China will change as it moves up the value chain and towards more sophisticated and cleaner technologies. China's management of the necessary rapid changes in the labour markets will require investing in the re-training of current workers and the provision of continuing education or lifelong learning.

China has already been active in recognising and managing these issues. For example, when construction was delayed or halted on 151 coal-fired power plants, China established a US$15 billion fund for retraining, reallocating and early retirement of the estimated 5-6 million workers who would be laid off due to coal or steel sector overcapacity (New Climate Economy 2018). These sorts of approaches will be important to both fostering human capital and maintaining social capital.

2) Skills to enable adoption of frontier technologies

Digital technologies and innovations, such as "dematerialised services" and AI, have the potential to radically increase efficiency and enable new business models across most sectors of the economy (Adams 2018). There will be real challenges in enabling humans to contribute productively alongside AI, rather than simply being directly replaced by machines. A highly skilled labour force is necessary for the adoption and application of such frontier technologies (Acemoglu and Zilibotti, 2001, Caselli, Coleman et al., 2006). For those without suitable skills, risk lower productivity, lower wages and lower standards of living (Che and Zhang 2018).

These AI-based technologies are far from maturity, and as they evolve and advance, China has the opportunity to invest in new skills as required by the development of digital technologies and to train its labour force to be effective, efficient and agile in an increasingly automated world. These complementary skills to AI, including coding or other computing skills, might be significant elements in future productivity growth. With the automation of whole categories of tasks, greater value will also be placed upon skills and talents that are different from and complementary to AI, such as those involved in human creativity or care.

3) Investment in education, especially in rural area

China has seen a substantial increase in investments in education since China's economic reform in 1978. The proportion of China's labour force having a college education increased from only 1.1 per cent in 1980 to 12.5 per cent in 2015 (Li, Loyalka et al. 2017). Despite the significant increases in educational attainment, the overall educational level of China's rural labour force is still extremely low. (Li, Loyalka et al. 2017) examined China's human capital in 2015 and concluded that only 11.3 per cent of rural workers in the 25-64 age group had

attained at least high school education; compared with 44.1 per cent for urban workers. There are also sharp regional disparities.

4) Investment in institutional reform

Different from most of the countries in the world, in China, the labour force has been divided into two distinct segments via the "hukou" policy, which identified the location in which individuals were allowed to live and work. In the early 1990s, the "hukou" system was relaxed after the launch of economic reforms, and labour force were no longer restricted to live and work only in the location specified in their "hukou" card. In 2014, 64 per cent of individuals living in China had a rural “hukou”, and 76 per cent were of working-age. Nearly one-third (31 percent) of workers with a rural “hukou” had migrated to work in urban areas by 2014 (Li, Loyalka et al. 2017).

However, nearly all administrative activities, most importantly housing, land distribution, school enrolment, medical insurance and social security, are still based on an individual’s “hukou” status. Children of migrants are not guaranteed places in public schools in cities; therefore, migrant children are barely found in higher-quality schools in urban areas. The denial of access to local public services, particularly the local education system, makes it difficult for rural migrants to live permanently and raise their families in cities. By the end of 2017, only 22 per cent of rural migrant workers had a basic pension or medical insurance, 18 per cent had health insurance, 27 percent had work-related injury insurance, and 17 per cent had unemployment insurance (The Ministry of Human Resources and Social Security, 2018)[13].

5) Investment in health care

Health is a significant driver of the productivity of human capital, as well as a key element in well-being. Public investment in health systems can show powerful economic and social returns, particularly those in areas of public health and prevention activities. Radically reducing pollution - strengthening natural capital - can be a particularly strong driver of improvement in health outcomes.

It has been estimated that air pollution leads to an estimated 1.2 million premature deaths per annum in China (Hannah Ritchie 2018), and costs an estimated 3.5% of national GDP annually (Umbach and Yu, 2016). One third of Chinese households rely upon solid fuels for heating and cooking, with indoor air pollution leading to an estimated over 600,000 deaths in China each year (Roser and Ritchie 2013). Changing cooking methods can increase social capital, raise productivity and enhance the quality of life. Women benefit significantly when

[13] http://www.mohrss.gov.cn/SYrlzyhshbzb/zwgk/szrs/tjgb/201805/W020180521567611022649.pdf

access to more productive and cleaner energy improves, including through the creation of more time for income-generating activities or childcare (both yielding higher productivity of human capital) or leisure (increasingly well-being). These ideas and actions will be powerful agents of change.

There are, of course, many important issues around health outcomes, including public health, life styles, access to medical services, care in the community, the needs of an ageing population and so on. These take us beyond the scope of this paper but are vital elements in both human and social capital.

3.3 Natural capital

Successful investment in and protection of natural capital involves clear national and community strategies, so that impacts are understood, their wider economic and systemic effects are evaluated, and appropriate choices can be made. China has implemented many successful reforms to improve the environment including in relation to public health (Huang, 2018). We focus here briefly on the quality of renewable natural capital, especially the air quality, control of GHG emissions, climate-smart agriculture and the nature of future urbanisation. The subject of natural capital in relation to future development strategy, of course, extends beyond these issues, although the issues we raise here are crucial for sustainable growth in the new era.

1) Investment in renewable natural capital

Renewable natural capital is often poorly managed around the world. However, underinvestment in renewable natural capital can lead to profound consequences for well-being via damages to ecosystems, loss of species, severe pollution and premature deaths.

Air pollution is a severe problem worldwide: according to the World Health Organization, more than 90 per cent of the world's population breathes polluted air every day. The United Nations Environment Programme (UNEP) (2019), suggests air pollution is responsible for 7 million deaths annually, or one in every thousand people in the world. Ritchie and Roser (2018) estimate 1.2 million premature deaths in 2010, with costs of 3.5 per cent of national GDP annually[14], from air pollution in China.

The Chinese government has designed policies to address both air pollution and climate change. The deadly smog in its cities has begun to be tackled by switching to natural gas from coal and via air management systems. Longer-term measures include investment in new public transport. China is targeting 5 million electric cars on its roads by 2020. These efforts

[14] Using standard processes for estimating the statistical value of a life.

are beginning to yield results, with air quality in 338 cities across China seeing a 6.5% improvement from 2016 (New Climate Economy, 2018).

Besides air pollution, Ebenstein (2012) finds that industrial activity has led to a severe deterioration in water quality in China's lakes and rivers and estimates that a deterioration of water quality by a single grade (on a six-grade scale) increases the digestive cancer death rate by 9.7%.

Land degradation is another issue. (Deng and Li 2016) suggested that the annual cost of land degradation was 1 per cent of China's 2007 GDP. China has built strong experience in restoring degraded land. It captures carbon in the soil, increases productivity and gives greater resilience. It constitutes all three of development, mitigation and adaptation. As well as action in China, it is an area of investment in which China could offer much to the world.

2) Investment in natural capital that contributes to the reduction of CO_2 emissions

On a global scale, the atmosphere constitutes natural capital of the most fundamental importance. GHG emissions play a vital role in its future. A major part of these emissions is associated with the functioning of our forests, land-use and oceans, vital elements of natural capital. We are already seeing the intensity of effects arising from past mismanagement. We are now, at 1°C, at the edge of the stable Holocene period of the last ten millennia, when our civilisation of villages and towns developed. The last 19 years have seen 18 of the warmest years on record. Disasters triggered by weather and climate-related hazards were responsible for US$320 billion in losses in 2017 (New Climate Economy, 2018).

The reduction of CO_2 emissions is core to the world's natural capital.

Significant achievements have been made in China, reducing CO_2 emissions and limiting the use of fossil fuel by better management of energy structure, cleaner energy and enhanced energy efficiency. The United Nations Environment Programme (UNEP) (2019), estimated that substitution of fossil fuels with clean energy, and with improvements in energy efficiency, cut carbon intensity by 45.8 per cent between 2005 and 2018.

Net zero emissions in the next 30 to 50 years may seem implausible to some, given the current structure of the Chinese economy, but China's remarkable economic achievements over the last 40 years would have seemed implausible to an observer in 1978. The incentives and rewards to 3 or 4 further decades of rapid reform may be even larger than in the past. And we can already recognise the possibility of a very attractive new sustainable and inclusive path, to the great benefit of China and the world.

Further, there are great potential local health benefits from policies which encourage switching away from fossil-fuels. For example, it is estimated that phasing in a US$70 carbon price in China could prevent nearly 4 million premature deaths from air pollution up to 2030 (Parry et al. 2016).

3) Investment in climate-smart agriculture

According to Food and Land Use Coalition (FOLU) (2019), agriculture contributed 7.2 per cent of China's GDP in 2018, and is the largest agricultural market in the world. At the same time, agriculture is responsible for a large proportion of surface-water pollution and is the leading cause of groundwater pollution in China. This has severe effects on aquatic ecosystems and human health (Mateo-Sagasta, Zadeh et al. 2017).

Much natural capital is affected by agricultural practices. China has the opportunity to develop climate-smart agricultural approaches (CSA) as a means to increase agricultural productivity sustainably, thereby raising the quality of life and public health, and protecting the environment. CSA cover new production systems including landscape farming approaches, intercropping and integrated crop-livestock management, improved water, soil, and nutrient management. They contribute to food safety. Effective CSA practices can produce higher productivity, create better jobs and income for farmers, and climate mitigation. They can be more resilient to difficult weather. Crop diversification and agroforestry have been shown to increase yields while avoiding environmental impacts (New Climate Economy, 2018). See also "Growing Better", FOLU, September 2019.

3.4 Social capital

The world is changing rapidly and creating major disruptions and potential risks to employment and labour markets. As we have argued in section 3.2, China can anticipate and prepare for these changes by investing in human capital to create a highly skilled, healthy, and flexible labour force that is well equipped for the challenges of the coming decades. The impacts of these changes together with shifting demographic trends require careful attention to social, as well as human, capital. Definitions of social capital vary (see section 2.4 above) but the concept refers to the ties within a society that facilitate co-operation within or among groups (OECD, 2009). In the context of this paper, we highlight some key elements of policy towards and investment in social cohesion, trust, sound institutions and just transition.

1) Investment in social cohesion and reducing inequality

China has emphasised the importance of a cohesive society and expressed concerns about inequality (Liu, 2017). Absolute poverty has reduced dramatically over the last four decades and evidence on consumption by poorer households in China indicates that the remaining

poor people are making strong progress towards climbing out of extreme poverty (Li and Pontes, 2018). However, there remain many poor people in China and there exists a large income gap between urban and rural populations (Li and Pontes, 2018). China's policymakers have highlighted the importance they attach to closing this gap, including the provision of equal access to good education and health services.

A strategy of reducing inequality and eliminating poverty in China would have several elements. First, educate and train for life-long learning. Second, when old activities fade, make particular efforts to provide re-training. Government revenues from environmental tax reform could be used in part for funding education, vocational training and re-skilling programmes. Third, provide assistance and finance for local entrepreneurship in starting or expanding small and medium enterprises. Fourth, provide help to move for those who wish to move, through information, finance and relaxing the hukou system. Fifth, provide social safety nets designed, as far as possible, to help reintegration into work or provide support or pensions for those who are unable so to do. In all this, active dialogue between local communities, employees, unions, employers and local government will greatly facilitate design that fits local circumstances and the reality and a sense of being involved.

2) Investment in just transition

Moving up value chains, and shifting towards the service sector, and adopting cleaner ways of producing, have all started to affect China's society, as well as its economy. Managing the phase-down of high-carbon industries and the millions of workers they employ, and to accelerate transitions within – or away from – the communities in which these industries are concentrated presents an important challenge. This is a universal challenge for all countries, but in China it is particularly pronounced due to the sheer size of its high-carbon and heavy industrial sectors. However, it is just one part of a bigger story. This includes the shift of demand towards services as economies get richer and their comparative advantage changes, a process that has moved very rapidly in China. Further there has been strong labour-saving technical progress, and much more is on the way. The management of the low-carbon transition should be set in the context of these major and continuing transitions (Stern, 2015, Averchenkova et al., 2016, Neuweg & Averchenkova, 2017). On top of these many communities around the world were hit strongly by the global financial crises.

The consequences of these transitions are often concentrated in particular regions where entire communities can be affected (Beatty et al., 2007). Their way of life is often closely intertwined with an industry that employs a large share of the local population. This is particularly relevant for mining communities. The effects on those communities often extend beyond concerns about economic means to support livelihoods. They include repercussions

on identity, social ties, 'the look and feel of the place' and the understanding of self. Scott (2010), for example, illustrates, through an ethnography of mountain top removal mining in Appalachia, the various social and communal ways in which attachments are formed through identity, place, and working-class masculinity.

The world community has not managed this fundamental change well. The result has often been anger and distrust. That undermines social capital, can have profound political consequences and can be an obstacle to future change.

3) Investment in trust

Prosperity and wealth depend not only on physical and human capital, but also our ability and freedom to live in a peaceful, trusting society, a safe and stable climate and healthy ecosystems. Simmel (1950) argues that "trust is one of the most important synthetic forces within society". High level of trust reduces transactions and monitoring costs and enables social and economic cooperation and exchange. (Knack and Keefer 1997) suggested a moderate increase in generalized trust could significantly boost economic growth. (Partha Dasgupta 2010) evaluated how higher levels of trust among economic agents can foster cooperation and productivity growth by encouraging trade and specialisation.

Social trust between citizens is not necessarily related to political trust between citizens and institutions. The formation of trust in people relies on cumulative experiences of trustworthy interactions with other people; while the formation of trust in institutions relies on broader social settings including shared ethical views, cultural norms and rules. See also Onora O'Neill (2002).

The building of a far-reaching social safety net, which consist of various welfare programs including health, social pensions, public works, and school feeding programs, targeted to poor and vulnerable households, can be a key element of investment in trust and social cohesion.

4) Investment in sound institutions

Society wastes resources when people distrust and are dishonest with each other. The economic literature on repeated games and punishment shows why cooperation makes social sense when people expect to interact in the future (Kreps et al., 1982). Yet people are surprisingly cooperative over and above what theory suggests is in their immediate self-interest (Paldam, 2000). This probably reflects the fact that we gain direct utility from living in a trustworthy society; perhaps for evolutionary reasons, social connectedness brings most humans intrinsic pleasure. Moreover, trust builds on trust.

Generalised trust and the quality of governance are both a result of, as well as a cause of, productivity growth and higher reported wellbeing. This mutual causation sets up a feedback mechanism which means sustained, carefully targeted policy interventions could trigger a virtuous cycle of good governance and higher productivity. This highlights the importance of investing in the quality of economic and political institutions.

(Olson, Sarna et al. 2000) conclude that the quality of governance and institutions accounts for a large part of the variation in rates of growth and investment across countries by supporting social capital. Clague et al. (1999) find that the quality of governance and institutions is important for explaining rates of investment. Investment and innovation in institutions, behaviours and cultures can build social capital. New technologies can sometimes even be harmful if not accompanied by sound institution which enables sustainable growth; for example, the lack of institutions which impose restriction on environmental pollution, soil degradation, and overfishing, or institutions that regulate employment and limit monopolistic rent seeking (Bennett Institute for Public Policy 2019). Developing a legal, judicial, and institutional framework to embed integrity and consistency into policy making can enable the effective and acceptable functioning of other types of capital.

Investment in sound institutions includes providing assistance and financial support for local entrepreneurship in starting or expanding small and medium enterprises. It is related to employment opportunities and access to social services especially for rural-urban migrants. It also involves reconsideration of intergovernmental assignments to ensure that local governments have strong and sustainable own-revenue sources. (Ahmad, Neuweg et al. 2019) focused on the intergovernmental fiscal system and discussed the role of sufficiently resourced local governments and the management of inter-temporal liabilities at provincial-level authorities.

Social and human capital are interwoven. Reforms of the intergovernmental fiscal system and wise and transparent spending decisions, including on infrastructure, can help manage or reduce income disparities. Sound, sustainable and inclusive local systems for funding public investment can foster social cohesion, trust and strong institutions.

4. Delivering prosperity through the 14th plan and BRI: focus on the four capitals

This paper shows how ignoring or neglecting China's capital assets or balance sheets comes with great risk. China's future development, well-being and quality of life will depend critically on the four capitals examined here.

The speed of technological change, global interconnection in trade and investment, and the need for fundamental structural change to achieve sustainability, together with a slowing overall growth rate imply that a changing balance in the Chinese economy can no longer occur simply by some sectors growing more rapidly than others; some sectors in the coming years will decline and be replaced by others. The effects in some places might be severe. Social cohesion and economic justice require that such transitions are managed.

Section 1 outlined how the necessary investment will boost China's prosperity in the short and long term, by driving not only a cleaner, safer and more secure society but also an economy that is more efficient, innovative and productive. Such investment also puts China in a strong position to lead the world in the resource-efficient, low-carbon revolution which is already underway. It noted that investment in new clean infrastructure and technologies offers many near-term opportunities to tackle issues related to waste, inefficiency, insecurity, pollution and congestion.

Section 2 outlined the importance of, and methods for, valuing the four key assets, physical, human, natural and social capital, noting the interactions and complementarities across all four. The assessment points to the need for investment in the measurement and valuation of key assets to provide a coherent and comprehensive dataset capable of informing policymakers. China is not alone in failing to value asset stocks sufficiently; it is a challenge faced by all major countries. But China may have more to gain from leading the way in developing and utilising new measures, for the reasons this report outlines.

Understanding the importance of valuing key assets augurs a programme of balanced investment as set out in section 3. Physical infrastructure must be upgraded to boost China's efficiency and productivity so as to generate innovation and knowledge that drive the new economy. Sizeable investment opportunities exist in clean technologies. Infrastructure will increasingly focus on compact, connected low-carbon and resilient cities. But the phase of development shaped by extensive investment in physical capital will become increasingly supplanted by investment in a broader range of assets

The paper highlights how the skills that are required to drive China's economy forward will change as it moves up the value chain into more sophisticated and cleaner technologies. This puts investment in adaptive and flexible human capital at the fore, including the training and re-training of current workers and the provision of continuing education. China's management of the necessary rapid changes in the labour markets will also require investing in complementary new networks and high-end technologies as well as the protection and restoration of natural capital.

Within human capital, the need for knowledge capital can be expected to expand as the country invests in innovation. But China's prosperity also depends on its ability to live in a harmonious and trusting society, with functional institutions, safe from climate risks, and without degraded ecosystems. In other words, China must invest in and nurture its social and natural capital.

Particular attention needs to be paid to natural capital. Unlike physical and human capital, natural capital, which provides a crucial building block for all other forms of capital, is generally in decline (World Bank, 2018). As a result, it poses one of the biggest threats to China's continued growth and prosperity. The air of cities has been severely polluted. So too have soil and water. Climate change is an immense risk. It is clear that strong global action is urgently needed, and that China, because of the size of its economy and emissions, must be a central player in climate action.

Resource productivity and efficiency will be powerful forces for growth in the new economy and there is real potential in the idea of the circular economy with its emphasis on design for re-use and recycling. Resource efficiency and productivity are also crucial elements for the protection of natural and human capital by decoupling growth from material use, environmental degradation and emissions. Unlike material resources, knowledge need not deplete if well-managed. Indeed, it can be self-reinforcing as knowledge builds on knowledge. This opens exciting and creative avenues for sustainable growth and prosperity.

Successful investment in, and protection of, natural capital, alongside investment in physical, human and social capital, involves clear national and community strategies. This is required for economic and systemic effects to be fully understood, and appropriate choices to be made. It is clearly and strongly recognised by the leadership in China: in President Xi's 19th Party Conference Speech (2017)[15] there were more references to "environment" and "green" (89 times) than the "economy" (70 times). Of the 14 elements in Xi Jinping thought, three relate directly to sustainability. China has actively participated in creating, observing and maintaining the Paris climate agreement of 2015.

The need to deliver a 'just transition' to a new growth era means all members of society must have the opportunity to participate, especially the poorer people in the society. This requires institutional innovation to keep up with the changing economy with enabling institutions that support and enhance social capital. Major change inevitably involves some dislocation. The policy response to climate change, the most pressing challenge of our generation, and to coping with the challenges presented by new technologies such as AI, big data and

[15] http://www.gov.cn/zhuanti/2017-10/27/content_5234876.htm

automation requires institutions that enable the implementation of a range of policies to manage dislocation and to turn the changes, for as many as possible, into opportunities.

Such issues arise more strongly now that China is an established producer in many sectors. Some of these sectors will contract. These include coalmining, steel and some of low-cost manufacturing. As well as enabling workers to reskill, structural reform requires transparent and efficient institutions which promote competition and innovation and limit rent-seeking and clientelism. Any policies not built on foundations of trust and effective institutions risk failure. This paper argues that adjustment costs are real, but that they can be managed creatively to offer opportunities across society as a whole.

In summary, securing sustainable returns from the four capitals requires investment and innovation in the new technologies that can give high-quality growth; in modern service sectors, including health, education, transport, communications and IT and logistics; in a strong financial system necessary to support private sector innovation and investment; in better functioning efficient modern cities, including in their infrastructure, the clean-up of pollution and congestion; in local governance and the ability to secure local finances; and in food and land-use systems; and in global governance, engagement and leadership. Together, these systemic reforms could foster the investments in physical, human, natural and social capital which will drive forward China's new era of high-quality, sustainable and inclusive growth and development.

More specifically, in order to drive the investments and transformations of the new era, Hepburn and Stern (2018) outlined reforms in seven areas of policy necessary to foster the entrepreneurship and innovation:

(1) high productivity and high-quality growth can be supported by clear and strong price signals, targeted standards, and enterprise reform;
(2) new blends of public and private finance can support investment in the four capitals;
(3) stable and productive city-level public finance can be based on transparent revenue streams from local taxation and payments for services, accompanied by transparent and quality expenditure;
(4) improved governance can deliver sound policies that are "predictably flexible", creating a positive investment climate;
(5) cities can be designed to be compact and clean;
(6) those affected by change can be supported with re-training, finance for entrepreneurship, social safety nets and other policies;

(7) China can take the lead, as the largest economy in the world, in shaping a well-functioning, rules-based, and equitable world order that enables increased trade and investment and the collective action necessary to protect the global commons.

The scale of China's influence on the world gives it new responsibilities. This will be China's century and its size and economic impact mean safeguarding the health of the world, including China's key markets, at a time of mounting environmental stresses. This will require clear and stable leadership, emphasising very strongly that the 14th plan and the BRI have to be understood together.

China can steer the future by developing and scaling the technologies the world will want to use and buy. But it can also anticipate the future, by making sure it does not lock into the technologies, behaviours and institutions of the past. Moreover, it can do so beyond its borders. The BRI is an opportunity to foster clean development in China's hinterland and its partners. The relationships between China and its trading partners, especially those in the BRI, will evolve to reflect the changing international division of labour in a rapidly changing world.

Moving up the value chain will require changing relationships between China and its trading partners. The countries of the BRI have income per capita and wages, on average and approximately, half that of China. If trade and infrastructure links can be established, and technologies advanced and shared, then the countries of the BRI could play a powerful and positive role in the spread of a more efficient, innovative and sustainable growth model. Just as China followed development paths different in crucial respects from the rich countries, the BRI countries will follow paths which are different in crucial respects from China. Showing lessons is part of partnership and progress.

Had the technologies of today had been available to China 25 years or so ago, its development path might have been much cleaner and more sustainable, to the great benefit of its citizens. If it had been able to look ahead more clearly to the problems of congested and polluted cities, it might have made policy and investments differently. BRI countries cannot make such a mistake and China has an opportunity, by exporting and investing new technologies and institutions around the world, to showcase the shortcomings in the 'grow now clean up later' approach to development (UNEP 2019). China is entering a new era of development that could transform not only its own economy, as it drives towards sustainable, high-income, knowledge-based production, but also the wellbeing, sustainability and prosperity of the rest of the world.

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