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Opinion Paper

Responsible Innovation in the contexts of the European Union and China: Differences, challenges and opportunities

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A B S T R A C T

The European Union (EU) has increasingly promoted "Responsible Innovation" (RI) policies in order to better harmonize technological progress with societal interest. RI has also triggered the attention of China, where it is included in the 13th Five-Year National Science and Technology Innovation Program (2016). However, each actor approaches RI in a different way. These differences could arguably be explained by three contextual factors: core values, goals of innovation and institutionalization logic. Taking into account the complex and global character of innovation-related challenges such as climate change, socio-cultural heterogeneity needs to be given serious consideration in order to achieve more effective RI dynamics in terms of anticipation, constituting common visions and goals and developing more coordinated international governance.

1. The emergence of Responsible Innovation: the EU and beyond

For the last three decades industrialized countries and governments, such as the European Union (EU), have increasingly promoted "Responsible Innovation" (RI) policies in order to achieve a better fit between science and engineering developments and socio-ethical concerns [1]. In its more contemporary forms, RI claims to be "taking care of the future through collective stewardship of science and innovation in the present" ([2], p. 1570). For instance, the European Commission claims that science and engineering activities under "Horizon 2020"—i.e., the EU's 8th Framework Programme for Research and Innovation (2014–2020)—should be conducted from a "Responsible Research and Innovation" (RRI) perspective, meaning that "all societal actors (…) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of European society" ([3], p. 4).

RI has thus become a policy driver in Europe, a tool to achieve more socio-ethically robust innovations by focusing on social needs and challenges [4], stakeholder inclusiveness [5], or anticipatory governance [6].

Simultaneously, RI has partially, or to some extent, attracted the attention of developing countries, including China [7], where the 13th Five-Year National Science and Technology Innovation Program (2016) advocates "responsible research and innovation, strengthening the ethical construction and education of scientific research, improving the ethical consciousness of science and technology workers, and guiding companies toward social responsibility concerning ecological protection and operational safety in technological innovation activities"[1].

Thus, RI is framed differently in the EU and China. The EU adopts a more political perspective, meaning that RI is mainly framed in terms of inclusiveness and open access, and implemented through a systemic policy program [3]. In contrast, China, a highly centralized and emerging country, appears to be more ethically oriented, namely, it mostly focuses on the individual responsibilities of scientists and firms rather than claiming profound transformations at governance level [8].

2. Heterogeneous RI: values, goals and institutionalization processes in the European and Chinese contexts

There are at least three contextual—and interrelated—factors[2] impeding the uniform, or universal, understanding and application of RI (see also Table 1):

- *Core values*: RI is an endorsement of public values embedded in policies, cultural constructions and institutional interpretations, which differ greatly from one region to another [9]. For example, social justice, sustainability, quality of life and safety—alongside,

[1] The State Council of the People's Republic of China: http://www.most.gov.cn/mostinfo/xinxifenlei/gjkjgh/201608/t20160810_127174.htm. Accessed 28 July 2017. (Authors' translation; original in Chinese.)

[2] These three factors (i.e., core values, goals of innovation, and institutionalization logic) have been identified and used as a baseline for comparison on the basis of a theoretical reflection on the normative and socio-political issues and considerations which arguably characterize and influence the dynamics and paths of any innovation system. In this sense, rather than reflecting a "canonical" or a formally established framework, these factors have been instrumentally produced in order to synthesize, or categorize, some of the main differences between European and Chinese RI governances.

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Table 1
Overall comparison between the EU and China on RI-related, socio-institutional contexts.

Socio-institutional factors	EU	China
Core values	liberal-democratic public values and "right impacts" (e.g., social justice, equality, and sustainability, in harmony with economic growth)	core socialist values of China (e.g., economic growth, industrial modernization, political stability)
Goals of innovation	in line with post-industrial development stage (e.g., sustainable development)	in line with pre- or early-industrial development stage (e.g., speed and daily-life impact of industrialization)
Institutionalization logic	bidirectional interactive mechanism, both top-down and bottom-up	policy driven and top-down decision-making mechanisms

and in harmony with, technological progress and economic competitiveness—have been identified as the EU's "normative anchor points" [4]. In contrast, China seems to be more exclusively interested in economic performance, employment security or political stability, in tune with the values of prosperity, civility, equality, rule of law, patriotism or dedication, which represent the normative ground of the nation, according to its central government.[3]

- *Goals of innovation*: Differences in research and innovation purposes, social evaluation and negotiation processes and in the political boundaries of research and innovation contribute to the contextual constitution of RI activities. RI is concerned with the economic, environmental and social impacts (both global and local) of innovation regarding the production, processing and consumption dimensions [10]. Take, for instance, disagreements between the EU and China on Carbon Dioxide Emission Reduction (CDER): while post-industrial EU countries mainly focus on attaining clean energy, healthy living and environmental sustainability, China seems to be more concerned about the impacts of CDER on daily life activities (e.g., cooling systems, driving), the speed of economic development and the advancement of modernization and urbanization.[4]

- *Institutionalization logic*: Responsibility not only matters with regard to specific technologies. It is also embedded in innovation agendas and represented by institutionally constructive processes relating to broader technology-society interactions. RI-related behaviors are motivated, facilitated and constrained by both formal and informal institutional elements, such as associated regulations and routines. Innovation activities in the EU are characterized in terms of inclusiveness, transparency and openness [5], governed by both top-down and bottom-up institutional dynamics. In contrast, innovations in China, which is a highly centralized country, are more inclined to be dominated by top-down political decision making routines ([7], pp. 83, 86–87).

3. Taking heterogeneity seriously: the value of difference for improvement

The complex and global nature of innovation-related challenges such as climate change, sustainability, digital security and inclusivity or poverty [11] arguably requires that international RI policies and practices be strengthened by improving the dialogue between different geographical and multicultural contexts such as the EU and China [12].

Contextual incommensurability surrounding RI framings implies the impossibility of evaluating them on univocally objective grounds. However, communication and dialogue between different interpretations and priorities remain feasible (normatively and epistemologically) [13]. Taking the constitutive socio-cultural heterogeneity affecting techno-industrial innovation activities seriously will be crucial in order to improve the awareness, coordination and effectiveness of RI policies around the world in at least three ways:

-*Strengthening anticipatory resources and willingness through international experience sharing*: Developing countries such as China could better anticipate and incorporate consideration of the negative impacts of progress into innovation practices by learning from the experiences of post-industrial regions such as the EU. For example, the Chinese "National Forest Cities" initiative, based on a string of "vertical forest" projects, is conceived as an anticipative urban/city plan, which involves issues concerning CO2 production and absorption, and environmental pollution [14]. Correspondingly, developed countries also benefit from the engagement of developing countries in global emerging science and technological innovations. For instance, the rapid growth of the Digital Mobile Payment Industry in China has driven developed countries such as the US [15], Japan and Korea [16] to rethink how they approach mobile payment opportunities in relation to mobile security issues.

- *Facilitating common visions for global well-being*: The scale and scope of global societal challenges call for comprehensive and common vision orientation among transnational stakeholders through initiatives such as the Paris Agreement on climate change [17]. In addition, the increasing engagement of China in innovation projects could trigger emerging niches for joint prosperity and sustainable development by constituting shared socioeconomic value between this country and the EU. The "One Belt One Road Initiatives" and "Asian Infrastructure Investment Bank", for instance, facilitate access to social capitals and resources for infrastructure construction, and developmental value reciprocity among countries [18].

- *Triggering more inclusive and coordinated international governance*: The increasing competitiveness and participation of developing countries in global affairs has led to the expansion and complexation of the responsible assessment of innovations in terms of geographical adaptability, improved forms of labor division and stronger transnational collaboration [19]. For instance, China is increasingly involved in the governance of genomic- and research and public health issues-related biobanks, entailing a broader set of genomic samples, the constitution of an international biobank network, more efficient data sharing and the development of comprehensive ethical and legal frameworks [20].

Author contribution

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[3] China Daily (Europe): "Core Socialist Values" (updated: 2017-10-12). http://www.chinadaily.com.cn/china/19thcpcnationalcongress/2017-10/12/content_33160115.htm. Accessed 24 October 2017.

[4] Based on interviews conducted by the Chief Science and Technology Consultant and the Vice Minister of the Chinese Ministry of Foreign Affairs, at the 15th Conference of Parties (COP 15) at the United Nations Framework Convention on Climate Change (UNFCCC), Copenhagen, Denmark, 2009.http://dk.china-embassy.org/eng/zt/climate/t646842.htm. Accessed 21 December 2009.

Editing, Project administration, Funding acquisition, Supervision.

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