

Smart Cities and the Idea of Smartness in Urban Development – A Critical Review

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Abstract: The concept of smart cities is becoming another mantra for both developing and developed cities. For instance, Indian government in 2015 announced its objective to build one hundred smart cities all over the country. They clearly stated that they are choosing smart development as the underlying concept for their future growth as a way to foster economic development in smart way to avoid the paths of rapid industrialization and pollution of cities as it took place in Europe and United States. The first of these smart cities, Dholera, is already under construction and it attracts journalists and urban planners from all over the world. The aim of this paper is to critically discuss the theoretical backgrounds and the practices of smart cities and examine the ways the concept is implemented. The paper is based on thorough study of literature and examining the two case studies of Dholera (India) and Songdo (South Korea). Smart city is a contested concept without a unified definition. It stems from the idea of digital and information city promoted using information and communication technologies (ICT) to develop cities. By installation of ICT municipalities obtain large sets of data which are then transformed into effective urban policies. One of the pilot projects of this kind was Rio de Janeiro and building the Center of Operations by IBM Company. City made a great investment into the smart information system before two huge events took place – FIFA World Cup in 2014 and Olympic Games in 2016. The project raised many questions including whether and how it improved the life of its citizens and in what way it made the city smart. The other definition of smart city is the idea of smartness in city development in broader sense. It focuses on smart use of resources, smart and effective management and smart social inclusion. Within this view, the ICTs are one component of the concept, by no means its bread and butter. Technologies can be used in a variety of ways. Problem occurs when smart city is viewed as means to make investments from city budgets by any price, by promoting use of smart technologies as the only way forward, as necessity. Many companies, including technological giants IBM and CISCO already participate on many smart city projects supplying technologies for smart city projects. In this study, we are looking into two case studies, the city of Dholera in India and city of Songdo in South Korea, both pompous large scale projects. Smart City technologies are growing market which is projected to be annually worth 20 billion dollars by 2020 [19], with IBM participating in 2000 projects accounting for 3 billion dollars [19]. There are many concerns about these developments, among them the issue of equity, whose purposes the projects are serving, how these initiatives are developing cities and the general idea of smartness in urban context. The research concludes that the ambiguity of smart city definition allowing multiple interpretations is frequently bent and used to promote the lobbying of strong players in cities and in private sector.



1. Introduction

The idea of smart cities is slowly diffusing into urban agenda and is becoming an overbearing concept of many new strategies all over the world. An evidence for this trend can be perceived in many cities across Europe, Americas and Asia where cities preparing their development plans for various time horizons increasingly more use the word 'smart' as characteristics of their desired development.

On the first look, it is a natural process where smart technologies are spreading also into urban agenda. New smart technologies are becoming part of everyday life of millions of people and it was a question of time until urban areas begin to capture this trend on larger scale. Nevertheless, the practice suggests that in the arena of urban development, the concept is rather unclear and vaguely defined and this creates space for ambiguous interpretations and vested interests of city governments and large information and communication technology (ICT) companies to be unraveled and executed.

The paper is attempting to review the critical notions connected with the idea of smart cities based on review of critical urban literature. In the first part it introduces the concept of smart cities and the basic notions characterizing them. The second part reviews the critique of smart cities and how the concept is by some urban actors to influence the city development in their interests. Lastly the paper briefly reviews two of the most iconic smart cities, the Songdo in South Korea and Dholera in India and provides hints of evidence of how the concept of smart cities is used for agenda setting of governmental and private companies.

2. The concept of smart city

Smart city is a buzzword for 2010s [31]. Whether we look at India's goal of 100 smart cities, utopian visions of Songdo or the rapidly growing number of city development strategies using the word 'smart', the Kitchin's idea of trend for 2010s seems about right. Since 2010 and the launch of IBM's Smarter City challenge [31] there has been an increase in calls from both academics, governments and businesses for creation of smart cities embedding ICT into the urban fabric. The smart city is here portrayed as the most effective way of dealing with growing population, climate change, environmental shocks and other global urban threats, including local urban problems of crime, congestion, inefficient services and economic stagnation [19]. Gabrys [7] argues that the overall point of use of ICT in smart cities is to enhance efficiency of its functioning.

Nevertheless, there is no a one universal definition of smart city. Smart cities as a concept provide a normalized vision of the future in which the technology is the primary driver for change [4]. It seems that technology often becomes the objective of the change instead as serving as a means to move the cities higher on the development ladder and technologies dominate. Using term 'smart cities' according to Marvin et al [4] contributes to creation of a new language of 'smartness' in the debates on cities, using terms such as smart cities, smart information, smart meters, smart grids or smart buildings. The expectation is for flexibility of networks, responsiveness to demand, aiming for green growth, connected communities and new services. IT companies such as IBM, Cisco or Toshiba are using the same terms for their products and they are becoming the main suppliers of technologies for smart cities.

Kitchin et al [31] differentiate two positions of perceiving smart city. The first one is favored by Greenfield [6] that the urban fabric is increasingly instrumented and composed of 'everywhere', and, secondly, the smart city's economy is driven by innovation and entrepreneurship with the goal of attracting business and jobs and focusing on efficiency, savings, productivity and competitiveness [6]. Hollands [19] also sees the dichotomy in smart city picture, there are corporate utopian visions ('ICT will save us') or academic circle definition which is more varied, diverse and complex. Smart city is sometimes being used interchangeably with wired, digital, informational, intelligent or ubiquitous, however these, unlike 'smart', do not always bear only positive connotations.

Critical urban scholars have produced analyses of several models similar to smart cities, such as cyber cities [3, 14], digital cities [9] or urban informatics [7]. In many of these concepts the notion is akin to smart cities, i.e. importance of technologies and their use in urban areas for competitiveness and urban wealth [4].

3. Undesirable effects of Smart cities

Smart city is an imprecise, rhetorical and highly ideological concept [4] and Hollands [11] argues that it is a new form of urban entrepreneurialism. Taken a step further, it can be perceived as a new form of rationalism where the technological rationalism is superior to everything in the city. Additionally, it creates a false illusion of neutrality. Varghese [9] warns before portrayal of smart cities as a panacea for all urban ills. Through the lenses of Flyvbjerg's rationality of power [7], the smart tools can create their own rationality and skew the perception of its citizens. McNeill [8] perceives smart cities as a way to further neoliberalization and marketisation of public services and links smart cities to New Public Management. Hollands [11] argues that the problem with smart cities is that they bring together distinct aspects which do not always fit together while hiding other problems. He continues that smartness of often a self-imposed label and a device of city branding.

In connection to the era of rational planning, it is possible to notice a sort of return to computer modelling from 1960s which is in 21st century largely enhanced by computer capacities and knowledge of cities and coding. Townsend [35] uses the term cybernetics redux. In Rio, based on the data the city is modelling the weather predictions for events such as floods and for traffic modelling of congestions. These tools use statistical probabilities instead of descriptive certainties and provide evidence that the absolute knowledge of how the city will perform can never be known [8]. The best that can be done is to produce a set of possible scenarios with accepting and accounting for its inherent uncertainties. In practice this means that city representatives can only use these scenarios as aids for decision making on the basis of personal, electoral or financial risk if to take preventive action or not.

- Kitchin et al [31] broadly define five critiques of smart cities:
- Growth of technocratic governance
- Hollowing out of the state and corporatization of urban government
- Creation of buggy, brittle and hackable city systems
- The production of panoptic surveillance
- Promotion of instrumental rationality and realist epistemology in the politics of urban data

Vanolo [32] uses the Foucauldian vocabulary and argues that smart cities use technology of government data at distance leading to further regulation and control over urban systems. However, unlike in case of rational comprehensive planning roughly in 1970s, the current technology has greater chance of achieving this objective due to higher efficiency and wider spread of tools gathering data and processing it.

The question of privacy is a valid concern, too. Large data companies are collecting data on their users and until now person had to be connected to network to be seen. In smart cities and its installing of CCTV and other devices the city is turning into Bentham's panopticon [37], [23] where people can be watched every moment of their lives. In Brazil's capital the IBM installed Center of Operations which scarily resembles Bentham's frightening metaphor. In 2010 IBM has launched campaign called Smarter Planet which is based using dashboards to visualize the gathered and analyzed data [8] fostering the panoptical views.

Marvin et al [4] perceive smart cities as enabling new ways of how new urban imaginations and urban knowledge can be generated through the use of urban dashboards by urban authorities and other stakeholders. Sennett [18] provides more subtle criticism that such information rich city may do nothing to enhance people's ability to think for themselves or communicate well with one another.

The data itself are benign and neutral as well as the algorithms processing the data and this is how the smart cities are presented. Recently, the big data are the key element of the current commercial, urban and social policy in many sectors (finance, education, healthcare etc.) [8]. Nonetheless, Kitchin et al [31] argue that the reality is more complicated and they raise the question such as how the data is obtained, what are the sample sizes, using what technology, in what context the data are gathered, the

ontology of the data – calibration and classification and lastly, the regulation of these processes – data sensing, privacy concerns. Citizen in smart cities is often perceived as a data point itself, as both generator of data and a responsive node in a system [7] supporting the idea of governing through code [19].

Kitchin et al [31] recall another Foucauldian idea of *dispositif* [9] which signifies the ideas, measures, propositions etc. enhancing and maintaining the exercise of power within the society. This way the power / knowledge is produced that is the knowledge which fulfills strategic function. Therefore, the data is never neutral, essential and objective in its nature; data are never new, always they are ‘cooked’ to recipe by chiefs embedded within institutions with aspirations and goals [31].

In connection to smart cities McNeill [8] uses the notion of introspection which he defines as the ability of the state to look within and open its own black boxes where the big data are hidden or locked from scrutiny by the department heads and on the case of the New York City he displays how the Giuliani’s Compstat technology was used as a means of targeting policy resources. In this case it was used at watching small crimes, beggars etc. according to the broken window theory. The truth, however, is that it was aimed at poor minority groups who were unequally more in the focus of police forces.

Choe et al [32] warns that urban planning and management and control of data have a potential to serve the interests and aspirations of the political elite and middle classes. Odendaal [37] presents a similar context in South Africa where governments see smart cities as golden key to the effective service delivery and governance. In 1990s the idea of e-governance led to increased surveillance as an attempt for digital city.

When looking at the market and marketing of smart cities, Hollands [19] considers them as a combination of aggressive marketing strategies and high profits to be made by large ICT companies. For example, Navijet research [19] estimates that ICT market is worth annually 20 billion dollars by 2020. IBM in 2016 was working on 2000 smart city projects worldwide in total value of 3 billion dollars [19] with a share of 25% of smart city operations. Harvey [23] speaks about entrepreneurial governance in which cities as competing for global capital and marketing and based on this Hollands [19] considers cities becoming a backdrop of corporate advertising.

4. Case studies

The following section reviews the critical literature on two very famous smart cities being built in India and South Korea. Both cities are being promoted as cities of future, blueprints for development and fix for current and potential urban problems. In this part the focus is on examining these optimistic notions and critically evaluating the way these smart cities are treating its citizens and looking behind the stated characteristics advertised by national and local governments and ICT companies behind them.

4.1 Dholera

In May 2014, the prime minister of India announced the objective of building 100 smart cities as a response to global challenges of urban migration and rapid urbanization [24]. Smart cities here were defined using Townsend’s definition as “places where information technology is combined with infrastructure, architecture, everyday objects and our own bodies to address social, economic and environmental problems” [35]. In Indian case the focus has been increasingly on the narrative of enterprises portraying local entrepreneurs as the new smart citizens turning India’s new urbanism into synonymic to the rhetoric of innovation and enterprise claiming modernity and development measured by growth in GDP and its footprint in global economy [24].

The city of Dholera is considered as India’s first smart city. It is located 100km from Ahmedabad in Western India and is deemed as a key to India’s smart city initiatives. The overall budget of 9 to 10 billion dollars is supposed to be covered from 10% by the government of India and Japanese private companies while the rest is supposed to come from private sector. Datta [24] when writing about Dholera uses terms such as ‘dubaisation of Africa’, ‘assemblage urbanisation’ or ‘worldling of cities’ to signify its turning into place of gated communities, new towns and satellite cities.

The government of India is aiming at attracting capital and investment and building of good infrastructure by promoting the idea of smart cities and uses urbanization as a business model [4]. The state of Gujarat positions itself as an entrepreneurial state with minimum government and maximum governance [24].

In speeches of the prime minister and plans and videos nobody mentions the current state of Dholera as it is an empty backdrop, terra nullis [24], an empty landscape-in-waiting for the smart city. Harris [26] argues that already between 2013 and 2015 the Indian newspapers and magazines were full of reports on smart cities, smart governance, smart leadership etc. Datta [27] depicts Dholera as a sign of entrepreneurial urbanism in India.

The greatest problem of the landscape in Dholera is flooding which is a reason for withdrawal of several previous investment attempts (seaport plan, Kalpatar dam). For the sake of 'public good' the peasants and landless farmers are losing their lands by land acquisition and dispossession [24].

Varghese [9] begins his analysis of smart cities in India by juxtaposing the issues of regular Indians who are on everyday basis concerned with electrical outages/power-cuts, crowded, delayed or dysfunctional public transportation, air pollution, insufficient water supply, non-existent drainage, the mosquito menace or the resulting health problems and argues that the prime minister's dream of 100 smart cities does not reflect the realities of Indian daily life.

Dholera was planned as a green field development and already became a site for many protests of people whose land was acquired and who were not informed about the decisions about their land which came from the top governmental levels [9]. Local population is neglected and not taken into the decision making processes and the issue of compensation for their land is usually taken after the decisions had been made.

4.2 *Songdo*

The second case study is South Korean Songdo which had been under construction since 2000s. The area of current city was reclaimed from the Yellow Sea covering the area of 48 square kilometres. It is a man-made island located 40 kilometers south from Seoul. It is marketed as North-east Asian trade hub linking Tokyo and Shanghai with smart, sustainable and technological ambitions with 40% of area being green spaces [33] scheduled to be completed in 2020 [31].

Songdo is a city planned by the government of South Korea and similarly as other cities planned this way it is an attempt to set the nation on a quick path to future development [31]. One of the objectives of Songdo is to test the concept and in case of successful implementation to export the model locally and globally [31]. For Korea, the city is twenty-first century's national gateway inviting global audience [32].

Songdo as a concept of smart city in Korean context reflects an attempt of combatting climate change and increased urbanization. It is not the first such city, the attempts can be traced back to 1970s and any of these initiatives stopped due to causes such as corruption, changes in political leadership or lack of funding [31]. Kim [32] argues it advances the Korean idea of post-colonial worldliness seeking to make the place for the nation in the global order of capital.

Initially planned as eco-city, in 2006 it was announced to become world's first ubiquitous city. Eco-city is features visible features while ubiquitous rather invisible ones [28]. Similarly to the earlier case of Dholera, Songdo is planned on top-down basis driven by national vision while paying little attention to society's needs. As Benedikt [31] argues, it is a case city chooses its citizens by selecting only the most educated ones within specific fields such as IT services while disregarding others. Shawayri [31] argues that it is designed in non-Korean style which underlines its plan to accommodate mostly non-Korean residents. The locals are expected to be employees of foreign companies while not having the privileges of foreign residents such as national health insurance. Shin [33] states that it is still missing

the flexibility accounting for technological advancements and it is purely an ideological vision torn away from reality.

Benedikt [31] argues that Songdo is an example of how smart city via the use of technological systems is reconfiguring its citizens into subjects they deem valuable in global economic competition. She contends this contributes to social exclusion and further marginalization of marginalized to remoter rims of society, being an expression of highly efficient clientele politics. Benedikt [31] additionally argues that the Korean government was trying to advertise the city as history-less neglecting the past of fishing tradition of coastal wetlands being homes of numerous fishermen which had to be eliminated due to this development. The city is built on destruction of former precious wetlands causing disappearance of some rare species. It is designed to be inhabited by foreigners with planned privileges and using the Korean locals as employees without required benefits.

Being promoted as a prototype of future smart city, it is interesting to note the segmentation of urban space reminding of Fordism overriding the objective to achieve higher productivity [31]. It further polarizes knowledge workers from the rest of population (uneducated, poor local population who can be superseded by technological systems, Benedikt [31] calls these jobs 'non-valuable' or as Lee [37], [23] calls them 3D jobs standing for 'difficult, dangerous and dirty') as advanced in Hollands hypothesis that in smart cities there will be little space for 'the others' [11] reminding of gated communities [31].

5. Implications for research

The research on smart cities shows lack of critical analysis on these ideas as often smart is seen the new sustainable as it is difficult to stand negative ground to the concept and the concept is too vaguely defined so that in practice it allows for very loose usage of the term, it is very easy to put brand of 'smart' on urban development projects. The existing research focuses greatly the technical, economic and engineering dimension of smartness while critical social or political analyses are sparse [4]. On this ground, it is crucial to express the need for more critical assessment of smart urbanism leading likely to deeper splintering of infrastructure [35] or deeper divides in access to what is branded as 'smart'. In this light, it is crucial to focus more in research on community, civic and metropolitan side of urban life and provision of resources [36].

The research in mainly of normative nature and in large part does not consider existence of alternative models such as the potential of smart cities for fuel the urban conflicts and foster more urban splintering resulting from unequal access to services [4] and assigning different value to urban dwellers [31] according to their access to and contribution smart city services and smartness.

The complexity of cities and smart cities in the research should incorporate the politics of smart cities, the capacities and capabilities of urban smartness and the emergence of fresh urban ways of knowing the city [4].

6. Conclusion

Smart cities should no longer stop at utilizing ICT. The key is to shape the cities using both human initiative and technology for social purposes [19]. The real problems of cities which are oftentimes not purely technological. In their existing nature, these South Korea and India cases, they try to fit the globalized smart city ideal yet they are supposed to invert this ideal to their spatial and social context.

The World Economic Forum clearly stated that in 2017 the greatest problem our planet is facing is inequality together with food security, poverty and scarcity of natural resources [37] which are in only a limited way reflected in smart cities. It is a high time for both scholars, entrepreneurs and public officials to be more critical to smart cities and other dreams of quick fixes to urban areas. Smart cities can provide valuable tools many towns and cities can utilize to become better, more equal, more developed, but they do not provide all the answers.

References

- [1] Hollands, R. (2016). 'Beyond the corporate smart city?: Glimpses of other possibilities of smartness'. In Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [2] Kitchin, R., Lauriault, T. P., & McArdle, G. (2015). Smart cities and the politics of urban data. In Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [3] Gabrys, N. (2015) Getting smart about smart cities in Cape Town: Beyond the rhetoric. In Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [4] Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [5] Greenfield, A. (2006). *Everyware: The dawning age of ubiquitous computing*. Boston. New Riders.
- [6] Caragliu, A., Del Bo, C. and Nijkamp, P. (2009) *Smart Cities in Europe*. Research Memoranda Series 0048. Amsterdam: VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics.
- [7] Boyer, M. C. (1992). The imaginary real world of cybercities. *Assemblage*, (18), 115-127.
- [8] Graham, S. and Marvin, S. (1996) *Telecommunications and the City*. London: Routledge.
- [9] Ishida, T. (2000). Understanding digital cities. In *Digital Cities* (pp. 7-17). Springer Berlin Heidelberg.
- [10] Foth, M., Choi, J. H. J., & Satchell, C. (2011, March). Urban informatics. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work* (pp. 1-8). ACM.
- [11] Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?. *City*, 12(3), 303-320.
- [12] Varghese, P. (2016). Exploring Other Concepts of Smart-Cities within the Urbanising Indian Context. *Procedia Technology*, 24, 1858-1867.
- [13] Flyvbjerg, B. (1996). The dark side of planning: rationality and 'real rationalitaet'.
- [14] McNeill, D. (2015). IBM and the visual formation of smart cities. In Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [15] Townsend, A. M. (2013). *Smart cities: Big data, civic hackers, and the quest for a new utopia*. WW Norton & Company.
- [16] Vanolo, A. (2014). Smartmentality: The smart city as disciplinary strategy. *Urban Studies*, 51(5), 883-898.
- [17] Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, 79(1), 1-14.
- [18] Sennett, R. (2012) No one likes a city that's too smart [online]. *Guardian*, 4 December. Available at: www.guardian.co.uk/commentisfree/2012/dec/04/smart-city-rio-songdo-masdar [Accessed 2 April 2017].
- [19] Bauman, Z., & Lyon, D. (2013). *Liquid surveillance: A conversation*. John Wiley & Sons.
- [20] Foucault, M. (1977). *Discipline and Punish: the birth of the prison*, trans. A. Sheridan.
- [21] Choe, K., Laquian, A. A., & Kim, H. (2008). *Urban Development Experience and Visions: India and the People's Republic of China*. Asian Development Bank.
- [22] Odendaal, N. (2015) Getting smart about smart cities in Cape Town: beyond the rhetoric. In Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [23] Harvey, D. (2002). From managerialism to entrepreneurialism: The transformation of urban governance in late capitalism. *The blackwell city reader*, 456-463.
- [24] Datta, A. (2015). The smart entrepreneurial city: Dholera and 100 other utopias in India. In Marvin, S., Luque-Ayala, A., & McFarlane, C. (Eds.). (2015). *Smart urbanism: Utopian vision or false dawn?*. Routledge.
- [25] Borpuzari, P. (2011) The need of the hour is to create integrated cities: interview with Amitabh Kant [online]. *Entrepreneur* 3 (4): 95-97. Available at: <http://entrepreneurindia.in/runandgrow/strategy-runandgrow/the-need-of-the-hour-is-to-create-integrated-cities/10598/> [Accessed 3 March 2017].
- [26] Harris, A. (2015). Smart ventures in Modi's urban India. *Dialogues in Human Geography*, 5(1), 23-26.

- [27] Datta, A. (2015). A 100 smart cities, a 100 utopias. *Dialogues in Human Geography*, 5(1), 49-53.
- [28] Yigitcanlar, T., Han, J. H., & Yeob, M. C. (2009, November). Managing Ubiquitous Eco Cities: Telecommunication Infrastructure Networks, Technology Convergence and Intelligent Urban Management Systems. In Knowledge City Summit Conference, Shenzhen, China.
- [29] Woyke, E. (2009) "Asia's Smart Metropolis." *Forbes*. 62-62.
- [30] Benedikt, O. (2016). The valuable citizens of smart cities: The case of Songdo City. *Graduate Journal of Social Science*, 12(2), 17-36.
- [31] Shwayri, S. T. (2013). A model Korean ubiquitous eco-city? The politics of making Songdo. *Journal of Urban Technology*, 20(1), 39-55.
- [32] Kim, J. I. (2014). Making cities global: the new city development of Songdo, Yujiapu and Lingang. *Planning Perspectives*, 29(3), 329-356.
- [33] Shin, D. H. (2009). Ubiquitous city: Urban technologies, urban infrastructure and urban informatics. *Journal of Information Science*, 35(5), 515-526.
- [34] Lee, Y. H. (2007). Workforce Development in the Republic of Korea. Policies and practices. Asia Development Bank Institute. <http://www.adbi.org/files/2007.10.29.book.korea.workforce.development.report.pdf> (accessed March 3, 2017)
- [35] Graham, S., & Marvin, S. (2001). *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition*. Psychology Press.
- [36] Finka, M., Ondrejčka, V., Jamečný, L. (2016) Urban safety as spatial quality in smart cities. Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, LNICST, 166, pp. 821-829. DOI: 10.1007/978-3-319-33681-7_73,
- [37] World Economic Forum (2017) What are the 10 biggest global challenges? [online] available at: <https://www.weforum.org/agenda/2016/01/what-are-the-10-biggest-global-challenges/> [accessed 2 April 2017]

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