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## **The Application of Artificial Intelligence at Chinese Digital Platform Giants: Baidu, Alibaba and Tencent**

Kai Jia, Martin Kenney, Juri Mattila , and Timo Seppälä

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Tencent

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Kai Jia

Assistant Professor

University of Electronic Science and Technology

Chengdu, China ([jiakspmm@163.com](mailto:jiakspmm@163.com))

Martin Kenney

Distinguished Professor

Community and Regional Development University of California, Davis

([mfkenney@ucdavis.edu](mailto:mfkenney@ucdavis.edu))

And

Research Director

Berkeley Roundtable on the International Economy

Juri Mattila

Researcher

The Research Institute of the Finnish Economy (ETLA) ([juri.mattila@etla.fi](mailto:juri.mattila@etla.fi))

Timo Seppälä

Researcher

The Research Institute of the Finnish Economy (ETLA)

And

Aalto University ([timo.seppala@etla.fi](mailto:timo.seppala@etla.fi))

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## Introduction

In 2016, the Chinese government identified artificial intelligence (AI) as one of the key priority areas in implementing a new government strategy. Since then, some nascent AI innovation hubs have emerged in Beijing (around Beijing-based Baidu)<sup>1</sup>, Shanghai (around Hangzhou-based Alibaba), and Shenzhen (around Shenzhen-based Tencent) (He, 2017)<sup>2</sup>. Many consider these three to have joined the leading hubs of AI development in the world today. All in all, China has started to develop significant research and technological capabilities in AI to catch up with the far more mature Western countries, those which has long histories of investing in computer science (Barton, Woetzel, Seong & Tian, 2017; Lee & Triolo, 2017).

Chinese digital platform giants—Baidu, Alibaba and Tencent (BAT for short)—have made advances not only in data collection, aggregation and interpretation but also in algorithm development. Furthermore, their platform business group model (PBG-model) has enabled them to generate huge volumes of data and to provide new data-based AI innovations to an enormous market that in size almost rivals that of their US counterparts (Google, Apple, Facebook and Amazon; GAFA for short) (for more information on PBG-model see Jia & Kenney, 2016). Given, on the one hand, the domestic success of the Chinese digital platform giants, and, on the other hand, the prevailing doubts on their ability to expand globally, whether AI will turn out to be a game-changer for BAT poses an interesting question.

Due to the rapid scientific progress in AI development in recent years, the application of AI

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<sup>1</sup> \$2.8 billion artificial intelligence park is currently being planned in Beijing, <http://www.straitstimes.com/asia/east-asia/28b-artificial-intelligence-park-planned-in-beijing> (accessed 5.2.2018)

<sup>2</sup> China's AI Awakening, <https://www.technologyreview.com/s/609038/chinas-ai-awakening/> (accessed 5.2.2018)

technology has lately become more commonplace in digital platform services. Some of the most notable examples of this include interactive assistants, such as AliGenie and Alexa, the transaction matchmakers embedded in Alibaba and Amazon, and the facial recognition algorithms used in Alipay and Apple Pay, to name a few.

Publicized venture capital investments in AI technology have grown rapidly. According to CB Insights, AI startups have raised, globally, over \$10 billion in aggregate equity funding.<sup>3</sup> The most well-funded Chinese AI startup in 2017 was Toutiao<sup>4</sup>. Overall, the Chinese AI technology startups are in full funding competition with their US counterparts<sup>5</sup>.

It is too early to tell whether AI will provoke a transformation greater than that initiated by the growth of the mobile internet, though it is certainly possible. However, it is important to recognize there have been at least two earlier highly hyped AI transformations that never occurred (for more information mobile internet see e.g., West & Mace, 2010)<sup>6</sup>. If one accepts the hypothesis that AI will become the next general-purpose technology, then it is vital for the Chinese internet giants to develop competences in AI. This is important because it is possible that AI will fundamentally alter the way people interact with digital technology. AI is likely to transform the way humans interact with their environment in nearly every field of human activity. As a result, services, manufacturing, and distribution will be fundamentally altered.

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<sup>3</sup> A ranking of the 100 most promising private artificial intelligence companies in the world, <https://www.cbinsights.com/research-ai-100> (accessed 6.2.2018)

<sup>4</sup> Global VC investment comes roaring back due to a resurgence in mega deals: KPMG Venture Pulse Q2 2017, <https://home.kpmg.com/xx/en/home/media/press-releases/2017/07/global-vc-investment-comes-roaring-back-in-q2-2017.html> (accessed 6.2.2018)

<sup>5</sup> China and the CIA Are Competing to Fund Silicon Valley's AI Startups, <https://cdn.defenseone.com/b/defenseone/interstitial.html?v=8.5.0&rf=http%3A%2F%2Fwww.defenseone.com%2Ftechnology%2F2017%2F11%2Fchina-and-cia-are-competing-fund-silicon-valleys-ai-startups%2F142508%2F> (accessed 6.2.2018)

<sup>6</sup> The WIRED Guide to Artificial Intelligence, [https://www.wired.com/story/guide-artificial-intelligence/?utm\\_content=buffer19c74&utm\\_medium=social&utm\\_source=linkedin.com&utm\\_campaign=buffer](https://www.wired.com/story/guide-artificial-intelligence/?utm_content=buffer19c74&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer) (accessed 6.2.2018)

It is likely that AI will strengthen the power of the incumbents, given their big data and their derived ability to test machine learning and other algorithms on that data. Then again, it is still possible for newcomers to challenge the digital platform giants by exploiting AI in vertical fields, potentially even reversing the bargaining power between the platform's owner and its complements. Similarly, the ongoing excitement and hype about the potential for artificial intelligence suggests that new ICTs may be profoundly changing the future of the platform economy at large (Brynjolfsson & McAfee, 2017).

This brief explores the AI strategies of the three largest Chinese digital platform giants: Baidu, Alibaba, and Tencent. It also analyzes how BAT are developing and using AI to improve their current performance and to prepare for the challenges they may confront in the future. Next, we discuss BAT investments in AI, their challenges, and the evolution of their platforms. We finalize our brief with conclusions.

## **BAT Investments in AI**

Due to the substantial improvements of machine learning in fields such as perception and cognition in recent years, AI is now being applied to a wide variety of fields, ranging from speech and face recognition to pharmaceutical R&D, stock trading bots, customer relationship management, etc. (Brynjolfsson & McAfee, 2017). Due to the enormous amount of data BAT have accumulated through their platforms, they are aggressively trying to exploit all sorts of AI. In Table 1, we briefly summarize what is now known about the efforts of these firms in three dimensions. The first dimension is the development of the technology itself in terms of R&D. The second dimension is the ways they are implementing AI in their operations. Finally, we summarize how they are investing in AI applications outside their own firms.

**Table 1 BAT Investment in AI**

	<b>Baidu</b>	<b>Alibaba</b>	<b>Tencent</b>
<b>Technology</b>	Baidu Cloud Baidu Brain	iDST/ET Brain A.I.Labs/AliGenie	Youtu Lab AI Lab/WeChat Lab
<b>Implementation</b>	Baidu Products Apollo DuerOS	Ali Products Smart City Brain AliGenie OS/Voice	Tencent Products AI Miying Xiaowei
<b>Investment</b>	Velodyne/xPerception KIT.T.AI/SoundAI	DiDi DeePhi Tech/Cambricon FACE++	DiDi/Ola/Uber NIO/Tesla Grail/Practo ZestFinance

**Source:** Summarized from the media reports from China by the authors.

## **Baidu**

Baidu, which is the Chinese analog to Google, has considered Google as its strategic competitor. Baidu began investing in AI in 2013 when it established the Institute of Deep Learning (IDL) and later followed up with investments in four other internal AI labs. Based on the developments from these laboratories, two new business initiatives were launched: the Baidu Cloud and the Baidu Brain. The former now provides an infrastructure to produce, analyze and tag data, while the latter serves as an algorithm platform open to complementary parties. It is reported that more than 370 000 developers and partners are working on the platform, invoking its functions more than 200 billion times per day.<sup>7</sup>

Baidu has been applying its newly developed AI technologies not only to its existing products—such as search or map—in order to improve the efficiency but also in new fields by creating two more platforms: the self-driving platform Apollo<sup>8</sup>, and the customized AI operation system DuerOS<sup>9</sup>. In

<sup>7</sup> See 2017 Baidu World Conference: Baidu Brings AI to Life, <http://www.nasdaq.com/press-release/2017-baidu-world-conference-baidu-brings-ai-to-life--20171116-00485>

<sup>8</sup> For more information on Apollo, See <http://apollo.auto/index.html>

<sup>9</sup> For more information on DuerOS, See <https://dueros.baidu.com/en/index.html>

addition to the implementation of these technologies, Baidu also invests in other companies especially in two fields: self-driving mobility and speech interaction, covering companies such as NIO<sup>10</sup> and KITT.AI<sup>11</sup>, respectively.

## **Alibaba**

Alibaba built its AI strategy on the foundation of iDST (Institute of Data Science and Technologies), a pre-existing data science research center established in Silicon Valley in 2014. By leveraging the research of iDST, Alibaba developed its cloud computing service which later evolved into ET Brain—an “artificial brain” platform open to businesses to make practical use of AI technology in any field.<sup>12</sup> In addition to iDST, Alibaba also established A.I. Labs in 2016, with a more direct focus on developing AI products. Based on that research, the interactive assistant AliGenie was introduced in 2017, allowing different kinds of services to be provided by Alibaba or third parties while leveraging Alibaba’s voice recognition and other AI capabilities.<sup>13</sup> Similar to Baidu, Alibaba also applies AI to improve the efficiency of its e-commerce and payment service. The company goes beyond that by integrating all kinds of urban services, such as traffic controlling and billing, into its AI ecosystem, building the “City Brain”.<sup>14</sup> Additionally, Alibaba expands vertically along the industry architecture, investing in AI hardware producers, such as DeePhi Tech<sup>15</sup> and Cambricon<sup>16</sup>, as well as in AI software developers such as Face++<sup>17</sup>.

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<sup>10</sup> For more information on NIO, See <https://www.nio.io/>

<sup>11</sup> For more information on KITT.AI, See <http://kitt.ai/>

<sup>12</sup> For more information on iDST and E.T. Brain, See <http://www.alizila.com/alibaba-cloud-wants-to-democratize-artificial-intelligence-technology/>

<sup>13</sup> For more information on A.I. lab and AliGenie, See <http://technode.com/2017/08/11/alibabas-first-consumer-targeting-artificial-intelligence-speaker-genie-x1-unveils/>

<sup>14</sup> For more information on City Brain, See <https://www.alibabacloud.com/blog/Interview-with-iDST-Deputy-Managing-Director-Hua-Xiansheng-City-Brain-%E2%80%93-Comprehensive-Urban-Cognition-221544>

<sup>15</sup> For more information on DeePhi, See <http://www.deephi.com/>

<sup>16</sup> For more information on Cambricon, See <http://www.cambricon.com/>

<sup>17</sup> For more information on Face++, See <https://megvii.com/>

## Tencent

Tencent's AI strategy started later than Baidu's and Alibaba's. Following the common practice at Tencent of setting up several teams to proceed simultaneously and to compete with each other on the same strategy, there are several research labs where the technical capacity of AI is explored. Thanks to the big data accumulated in its social network, Tencent has the superiority in speech and image recognition. The company applied the capability to its existing products, helping WeChat to support more intelligent functions and Games to offer the players better interactive experience in the virtual world. The most highlighted expansion of Tencent is the medical R&D, especially in the field of medical imaging recognition and analysis. Tencent developed Miying<sup>18</sup> system itself and invested in medical research companies such as Grail<sup>19</sup> and Practo<sup>20</sup>. In addition, Tencent also invests in the self-driving industry, with companies such as NIO and Tesla.

## Challenges: Risks of BAT in AI

Despite the opportunities, there are still potential challenges for BAT in the AI era. At least three clear challenges can be identified.

First, disruptive new entrants may emerge who will leverage AI and disrupt the existing business areas of BAT. An example of this possibility is Toutiao,<sup>21</sup> which is an information content platform established in 2012 that utilizes AI to recommend targeted content to users based on the analysis of the features of content, users' preference and their interaction with content. It has grown to have 120 million

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<sup>18</sup> For more information on Miying, See <https://aiyixue.qq.com/official/> or <https://medium.com/@actallchinatech/ai-in-all-tencents-ambitious-ai-plans-for-business-partners-95a9383d224a>

<sup>19</sup> For more information on Grail, See <https://grail.com/>

<sup>20</sup> For more information on Practo, See <https://www.practo.com/>

<sup>21</sup> For more information on Toutiao, See <https://www.crunchbase.com/organization/toutiao>



daily active users and has an estimate market value of \$20 billion as of the first quarter of 2017.<sup>22</sup> Toutiao's revenue model is now confined to serving ads and thus is aiming to be a competitor with BAT as they are also competing in digital advertising space. The utilization of AI greatly improves the user experience and might even result in the substitute of the incumbents given its current increasing rate.

Second, an existing competitor might develop a higher competence in AI and challenge the leading role of BAT. One example of this possibility is JD.Com<sup>23</sup>. As the second largest e-commerce platform in China, JD.Com differs from Alibaba in that it owns and operates the warehousing and logistics system itself, incurring huge sunk costs. However, JD.Com is leveraging AI, especially the unmanned-aerial-vehicle and robots, to unfold the potential of its distribution network. Although Alibaba is investing in warehousing and logistics too, it confronts the challenges from JD who has turned the disadvantages to advantages, thanks to AI. Furthermore, both JD.Com and Alibaba follow the examples of Amazon and Facebook in reference to the importance of logistics behind platform.

Third, an original competitor to the platform of BAT might grow to be the new leader in a vertical sector thanks to AI technology, which in turn would affect the bargaining power of the platform owner. DiDi<sup>24</sup> and Meituan-Dianping (MD)<sup>25</sup> are two examples of such a possibility. DiDi is a ride-hailing platform and MD provides on-demand services, both of which are affiliated with and benefit from the platform of Alibaba and Tencent. For example, both use Alipay and WeChat payment. DiDi and MD have accumulated big data in each vertical sector, and both could be exploited using ML to improve the efficiency of planning the route and matching the transactions. The huge amount of sector-specific

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<sup>22</sup> See <https://www.reuters.com/article/us-china-toutiao-fundraising/chinese-startup-toutiao-raising-funds-at-over-20-billion-valuation-sources-idUSKBN1AR0DE>

<sup>23</sup> JD.com is the second largest B2C e-commerce platform in China. It was listed on Nasdaq in 2014. As of September, 2017, the platform has 266.3 million active users and net revenues for the third quarter of 2017 were RMB83.7 billion (US\$212.6 billion), an increase of 39.2% from the third quarter of 2016. See <http://ir.jd.com/phoenix.zhtml?c=253315&p=irol-newsArticle&ID=2316367>

<sup>24</sup> For more information on DiDi, See <http://www.didichuxing.com/en/>

<sup>25</sup> For more information on MD, See <https://www.crunchbase.com/organization/dianping>

data and the capacity to exploit data might help DiDi and MD to restructure their relationships with BAT.

### Platform Evolvement of BAT in AI

Jia and Kenney (2016) argued that BAT developed the platform business group (PBG) model in a large and partly protected market, expanding horizontally across sectors and resulting in isomorphism and cross-market horizontal oligopolistic competition. Given the opportunities and challenges provoked by AI technology, it is still important to analyze how the PBG model of BAT will evolve in the future.

First, it is clear to see that BAT are adopting the PBG model in the field of AI, with each firm deploying AI technologies in the business areas where they have their greatest strength (see Box 1). In Nov. 2017, the central government of China identified four national AI platforms, three of which are already fields of interest by BAT, namely, self-driving, smart city, and medical R&D respectively, indicating their potential superiority in each sector.<sup>26</sup> Therefore, it might be possible to see some divergence of their PBG models in the future as they may develop emphases in different sectors.

**Box - Strengths of BAT in Different Areas<sup>27</sup>**

	Smart City	Self-Driving	Medical R&D	Interactive AI	Finance	Retail
Baidu	+	+++	+	+++	+	+
Alibaba	+++	+	++	+++	+++	+++

<sup>26</sup> For more information, See <http://www.scmp.com/tech/china-tech/article/2120913/china-recruits-baidu-alibaba-and-tencent-ai-national-team>

<b>Tencent</b>	++	++	+++	++	++	++
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**Note:** A subjective scale of the strength of each company in each specific field, with “+++” representing the strongest position and “+” symbolizing the weakest. The evaluation of strength in the categories is based on the following comparative criteria:

**Smart City:** The number of Chinese local governments in the municipality level that have signed pertinent strategic cooperation agreements with BAT.

**Self-Driving:** The phase of related R&D maturity at BAT, as covered by the media. For example, Baidu has conducted 1971 miles of vehicle testing in California in 2017. Tencent has produced several prototypes of self-driving vehicles but Alibaba has only made several self-driving vehicle assemblies.

**Medical R&D:** The number of medical institutions that have signed pertinent cooperation agreements with BAT.

**Interactive AI:** The number of pertinent products issued by BAT and the number of pertinent third-part cooperators.

**Finance:** The phase of pertinent product maturity at BAT, as covered by the media. For example, Alibaba has leveraged AI to provide professional financial services covering credit, risk management, targeted sales, etc. Tencent is providing general services such as identity confirmation and customer services, while Baidu is still experimenting the business model of its AI technology in finance.

**Retail:** The phase of pertinent product maturity at BAT, as covered by the media. For example, Alibaba has implemented AI in customer services, commodities recommendation, logistic robots, etc. Alibaba has also experimented with a new business model of unmanned stores. Tencent is providing retailers with AI services, e.g. facial recognition, customer featuring, etc. However, few AI products are reported in this field from Baidu.

Second, despite the challenges, the advantages of BAT might still exist, and the PBG model may sustain its vitality. Given the current level of AI technology, sector-specific implementation is of great

value, which means that newcomers might have the chance to catch up and even replace the incumbents. However, while AI empowers the challengers, it also helps BAT exploit their big data and thus improve their businesses as well. Baidu search is becoming more versatile by integrating speech and image recognition. Alibaba provides customized loans to users based upon analysis of their historical transaction data. Tencent is developing better interactive services by training the social network data. Given the generality of these functions, it should be expected that BAT will expand to yet other sectors, thereby strengthening the PBG model. However, it still needs to be emphasized that there indeed exist opportunities for the latecomers, especially those who have sector-specific data.

Finally, from a global perspective, the BAT may be able to expand beyond China into other countries, particularly in South, Southeast and Central Asia. They may experience greater difficulty advancing into the developing nations. Despite the doubts regarding the globalization of BAT from their relatively closed market, their investments in AI illustrate they are intent upon moving to the global ICT technological frontier. While it is difficult to definitively assess the technological capabilities of the Chinese firms, there is anecdotal evidence that the Baidu self-driving platform, Alibaba's cloud computing services, and Tencent's perception and cognition technologies, at least, rival their US West Coast counterparts. As is the case in the US, BAT have opened aspects of their AI infrastructure to developers to extend them to other sectors and possibly to evolve into other platforms in the operating system or even at lower layers in the stack.

## **Conclusion**

The call to action by China's political leadership, along with the investments in AI by BAT and others could set China on a course towards a manufacturing-backed technology-fueled economic

transformation. China and its large industrial sectors, such as manufacturing and digital platforms, have been fast to invest in AI and to embrace change. The Chinese platform giants also have access to enormous data sets that rival those of their US counterparts, potentially acting as an equalizer – and something that no other country has.

In general, AI can act as a catalyst in reorganizing platform-based business models and the respective industry architectures. AI-driven applications could be the next artifact innovation, which will modify users' behavior, either by providing users with new alternatives or connecting them with new resources, platforms and value. As an example, the prevalence of voice recognition could replace the text-based search engine and disrupt the way people interact with the resources and value offered by businesses, causing new industry standards, platforms and architectures to emerge consequently.

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