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

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Abstract

The Chinese digital platform giants – Baidu, Alibaba and Tencent – have quickly risen to be amongst the most notable developers and users of artificial intelligence. One important catalyst for this development has been the so-called *Platform Business Group (PBG)* strategy used by Chinese digital platform firms. In this strategy a platform firm aims to develop powerful synergies by tightly linking together a number of different platforms it owns so as to offer multiple services to users under its umbrella. By applying the PBG strategy, Baidu, Alibaba, and Tencent are able to exploit enormous multi-faceted datasets on individuals for use in the development of artificial intelligence algorithms. As a result, the Chinese platform giants appear to be taking a somewhat different approach with the development and use of artificial intelligence than their Western counterparts. If the Chinese platform giants succeed in their efforts to expand into the global market, their business strategies will introduce a different threat to the conventional European industries from those challenges already presented by Apple, Amazon, Facebook, Google, and Microsoft.

Key words: Artificial Intelligence, Platforms, Platform Business Group strategy, Baidu, Alibaba, Tencent

JEL: L8, L86, O3, O33

Baidun, Alibaban ja Tencentin tekoälystrategioista

Tiivistelmä

Kiinalaiset alustatalouden jättiläiset, Baidu, Alibaba ja Tencent, ovat lyhyessä ajassa nousseet maailman merkittävimpien tekoälyteknologian kehittäjien ja hyödyntäjien joukkoon. Katalyyttinä tälle kehitykselle on toiminut kiinalaiskolmikon soveltama niin sanottu PBG-strategia (*Platform Business Group strategy*). Sen ajatuksena on, että alustayritykselle syntyy synergiahyötyjä, kun kuluttajille suunnatut palvelut yhdistetään yhdeksi monitoimialaiseksi palvelukokonaisuudeksi. PBG-strategian soveltaminen on mahdollistanut kolmikolle poikkeuksellisen laajojen ja moniulotteisten datamassojen hyödyntämisen tekoälyalgoritmien kehityksessä. Aasialaisten alustajättien tekoälykehitys vaikuttaakin muodostuvan varsin erilaiseksi verrattuna yhdysvaltalaisten alustajättien tapaan kehittää ja hyödyntää tekoälyä. Mikäli kiinalaiset alustatoimijat onnistuvat pyrkimyksissään laajentua globaaleille markkinoille, ne tulevat muodostamaan Euroopan perinteisille toimialoille täysin uudenlaisen uhkakuvan Googlen, Androidin, Facebookin ja Amazonin tuomien haasteiden rinnalle.

Asiasanat: Tekoäly, Alustat, PBG-strategia, Baidu, Alibaba, Tencent

JEL: L8, L86, O3, O33

1 Introduction

In 2016, the Chinese government identified artificial intelligence (AI) as one of the key priority areas and began the implementation of new government strategy. Since then, nascent AI innovation hubs have emerged in Beijing (centered upon Beijing-based Baidu)[1], Shanghai (centered upon Hangzhou-based Alibaba), and Shenzhen (centered upon Shenzhen-based Tencent) (He, 2017)[2]. Many consider these three cities to be among the leading AI-development hubs in the world. All in all, China is developing such significant research and technological capabilities in AI in an effort to overtake the far more mature Western countries that have far longer histories in computer science (Barton, Woetzel, Seong & Tian, 2017; Lee & Triolo, 2017). Perhaps the most powerful indicator of increasing Chinese capability is the decision by Google to re-open its Chinese research operation with a focus on AI.[3]

Over the last decade, but particularly in the last five years, the Chinese digital platform giants – Baidu, Alibaba and Tencent (BAT for short) – have made enormous technological advances not only in data collection, aggregation and interpretation but also in algorithm development. Furthermore, their platform business group model (PBG-model) allows them to generate enormous volumes of data, as well as provide new data-based AI innovations to an enormous market that in size nearly rivals that of their US counterparts (Google, Apple, Facebook and Amazon; GAFA for short) (for more information on PBG-model see Jia & Kenney, 2016).[4] Given, on the one hand, the domestic success of the Chinese digital platform giants, and, on the other hand, the prevailing doubts of 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 technology has recently become more commonplace among 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.

Even as the Chinese platform leaders have accelerated investment in AI, venture capital investments in AI technology have also grown rapidly. According to CB Insights, AI startups have raised, globally, over $10 billion in aggregate equity funding.[5] The most well-funded Chinese AI startup in 2017 was Toutiau, which uses AI algorithms to recommend news and websites to its users[6]. As is the case in the US, Chinese AI technology startups are receiving enormous

1 $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)

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

3 Vanian, J. Google Plans Big AI Push in China. Fortune. December 13, 2017 http://fortune.com/2017/12/13/google-china-artificial-intelligence/

4 As Stuart Feldman pointed out to us, only the Chinese platform firms deal every day with data on the scale of the US West Coast firms.

5 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)

6 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)

amount of funds to the point where some in the press are claiming there is a funding competition for startups between the two nations[7].

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 (for more information on mobile internet see e.g., West & Mace, 2010). It is also true that there have been at least two earlier and highly hyped AI transformations that never had significant economic impact.[8] 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. As nearly every business is becoming digitally enabled with decisions made by algorithms, there is a possibility that AI will transform the way humans interact with their environment – in many cases, in ways that are not yet clear. Already, machine learning-driven algorithms have become as accurate as physicians in diagnosing skin cancer.[9] As a result, services, manufacturing, and distribution will be fundamentally altered.

Given their big data and their derived ability to test machine learning and other algorithms on that data, it is likely that AI will strengthen the power of the incumbents. 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 AI suggests that it may profoundly affect the future of the platform economy at large (Brynjolfsson & McAfee, 2017).

2 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). Additionally, because of the enormous amount of data that BAT has accumulated through their platforms, they are now 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 are the ways they are implementing AI in their operations. Finally, we summarize how they are investing in AI applications outside of their own firms.

[7] 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)

[8] 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 (accessed 6.2.2018)

[9] Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M. & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. *Nature*, 542(7639), 115.

Table 1. BAT Investment in AI

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

Source: Summarized from Chinese media reports 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.[10]

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[11], and the customized AI operation system DuerOS[12]. In addition to the implementation of these technologies, Baidu also invests in other companies especially in two specific fields: self-driving mobility and speech interaction, covering companies such as NIO[13] and KITT.AI[14], respectively.

Alibaba

Alibaba, which roughly speaking can be considered the Chinese analog to Amazon, built its AI strategy on the foundation of iDST (Institute of Data Science and Technologies), a pre-ex-

[10] *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

[11] For more information on Apollo, *See* http://apollo.auto/index.html

[12] For more information on DuerOS, *See* https://dueros.baidu.com/en/index.html

[13] For more information on NIO, *See* https://www.nio.io/

[14] For more information on KITT.AI, *See* http://kitt.ai/

isting 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.[15] 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 new services to be provided by Alibaba or third parties that leverage AliBaba's voice recognition and other AI capabilities.[16] Alibaba applies AI to improve the efficiency of its e-commerce and payment services and it is also working to integrate various urban services, such as traffic control and transportation billing into its AI ecosystem by building the "City Brain".[17] Additionally, Alibaba is integrating vertically by investing in AI hardware producers, such as DeePhi Tech[18] and Cambricon[19], as well as in AI software developers such as Face++.[20]

Tencent

Tencent, which has no clear analog in the West, initiated an AI strategy 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. Due to the large data accumulation in its social network, Tencent has developed superiority in speech and image recognition. The company is applying these capabilities to existing products, such as helping WeChat support more intelligent functions and its various game offerings thus providing players better interactive virtual experiences. The most touted new expansion has been of Tencent into R&D, especially in medical imaging recognition and analysis. Tencent also developed the Miying[21] system, which is an AI-assisted medical diagnosis system. It has invested in medical research companies such as Grail[22] and Practo[23]. Finally, Tencent has made investment in the self-driving firms, such as NIO and Tesla. All of these fields require enormous amounts of data and the development of sophisticated AI-based algorithms.

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

16 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/

17 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

18 For more information on DeePhi, *See* http://www.deephi.com/

19 For more information on Cambricon, *See* http://www.cambricon.com/

20 For more information on Face++, *See* https://megvii.com/

21 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

22 For more information on Grail, *See* https://grail.com/

23 For more information on Practo, *See* https://www.practo.com/

3 Challenges: BAT and AI

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

First, there is a significant amount of venture capital funding in the AI field that might result in new entrants emerging that could leverage AI and enter the existing business areas of BAT. An example of this possibility is Toutiao,[24] which is an information-content platform established in 2012 that utilizes AI to recommend targeted content to users. This is done based on the analysis of the features of content, users' preference and their interaction with content. It has grown to have 120 million daily active users and has an estimated market value of $20 billion as of the first quarter of 2017.[25] Toutiao's revenue model is now simply serving ads and can thus compete with BAT in digital advertising. Toutiao's AI improves the user experience and might allow it to encroach on the space of the existing firms.

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[26]. 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 increase 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 due to AI technology, which in turn would affect the bargaining power of the platform owner. DiDi[27] and Meituan-Dianping (MD)[28] 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 data and the capacity to exploit data might help DiDi and MD to restructure their relationships with BAT.

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24 For more information on Toutiao, *See* https://www.crunchbase.com/organization/toutiao

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

26 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. As importantly, JD has very strong relationships with Tencent.

27 For more information on DiDi, *See* http://www.didichuxing.com/en/

28 For more information on MD, *See* https://www.crunchbase.com/organization/dianping

4 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.

Strengths of BAT in Different Areas

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

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.

First, it is clear that BAT are deploying AI technologies into the business areas where they have their greatest strength (see Box 1). In Nov. 2017, the Chinese government identified four national AI platforms, three of which are already in fields being explored by BAT, namely, self-driving, smart city, and medical R&D respectively, which may lead to the development of a national champion in each technological field, though it is also possible that there will be new entrants in these fields.[29] This might lead to some divergence between the three firms, as they may develop emphases in different sectors.

Second, despite being faced with many challenges, the technical and business advantages of BAT still may be determinative of future success. Given the current level of AI technology, sector-specific implementation is still important and this suggests that newcomers with new technologies and business models may be able develop new niches and possibly even replace the incumbents. While AI provides opportunities to challengers, it also helps BAT exploit their big data and thus improve their businesses. So, for example, Baidu search is becoming more versatile by integrating speech and image recognition. Alibaba is using its data and analytics to provide customized loans to users. Tencent is developing better interactive services through training on its social network data. Given the generality of these functions, capabilities developed in one sector should be transferable to other sectors, thereby reinforcing the PBG model. This does not mean that BAT will necessarily overwhelm sectoral giants such as Ctrip in travel, where, in fact, Alibaba's Fliggy has had difficulty gaining market share (Shao and Kenney 2018).

Finally, from a global perspective, 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. Moreover, it might still be possible for BAT to expand globally by leveraging AI to strengthen their existing advantages, especially their world leading payment services. Alipay is using face recognition as the method of identification to further simplify its payment service. The company is also experimenting with Alipay in IoT, looking to enable autonomous transactions between devices. Once accepted as the worldwide standard, the global business environment would be transformed as well.

[29] For more information,
See http://www.scmp.com/tech/china-tech/article/2120913/china-recruits-baidu-alibaba-and-tencent-ai-national-team

5 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-driven, 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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