
A Tale on Chinese Innovation and Competition: A Brief History and Outlook of the Chinese Telecommunications Equipment Industry

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These are complementary notes on a previous case study on the Chinese telecommunications equipment industry and its global potential (Gottinger,2013).

We examined the four largest Chinese suppliers of stored program control (SPC) switches: Datang Telecom Technology (DTT), the Great Dragon Information Technology (GDT), Huawei Technologies (Huawei), and Zhongxing Telecommunication Equipment (ZTE). The tale shows how these four Chinese suppliers competed against the two largest SPC switch manufacturers that had foreign joint venture partners :Shanghai Bell an Alcatel joint venture, and Beijing International Switching System (BISC), a Siemens joint venture , and further how they competed globally against well established suppliers of telecommunications equipment (TE)such as Alcatel, Cisco, Ericsson, Fujitsu, NEC, Nokia, Nortel, and Siemens.

First, the fast growth in the period after 1985 of two suppliers, Huawei and ZTE, requires appropriate attention. Their success threatens well established incumbents' plans to dominate the global and China markets for TE. ZTE started operations in 1985, and Huawei in 1988. In slightly over ten years, Huawei became the number one supplier of TE in China. In 1998. Huawei's annual revenues exceeded those of the top two TE suppliers that had foreign joint venture partners: Shanghai Bell and BISC, and since then had the gap growing. Still, in the mid eighties, the possibility that any of the four Chinese suppliers could pose a serious threat to established global suppliers seemed very improbable. Today, Chinese suppliers compete aggressively against these well established global suppliers and their joint ventures in China.

For example, reputable market share tracking firms ranked Huawei the number one supplier in the global market for new extended switching equipment in 2003, the number one supplier in the global market for new generation networks in 2004, the number two supplier in the global market for digital subscriber line (DSL)access multiplexers in 2003, the number three supplier in the global market for long distance wavelength division multiplexers, and the number four supplier in the global market for optical transmission. Huawei and ZTE have been ranked the number three

and eight suppliers in the global market for integrated access networks. As the Wall Street Journal reported repeatedly in 2003 to 2005, executives of North American and European vendors of TE have become increasingly concerned about the head-to-head competition from Chinese suppliers.

On the basis of previous models of competitive racing (Gottinger, 2006, 2009) we trace empirically the various stages of competitive strength in this strategic industry.

In the first stage we observe that the four startups targeted the basic need for infrastructural development in telecommunications in Western and rural China in supplying low cost telecommunications gear to those areas which were less lucrative for foreign vendors and joint ventures and were heavily encouraged by the Chinese national government in a sort of infant industry protection. This kind of asymmetric competition separated the startups from the established players in the Chinese market, call it the *separation stage*.

In the course of this stage the 'four horsemen' underwent technological learning either through indigenous innovation or imitation of some sort, even industrial espionage in China,therefore gaining competitive strength and competing against foreigners on large scale projects in the Chinese market. This is termed the *convergence stage*. When asymmetric competition turns symmetric we observe competitive convergence , in which each technology's development is directed at expanding its appeal not only in its own home market but in its rival's as well.

While the Chinese companies with the implicit support of the Chinese government continued to gain market share against foreign competitors and as their technological learning advanced product quality at lower cost they expanded in actively seeking to bid successfully for telecommunications projects in developing and emerging economies where they gained further strength by competing on given product quality and lower prices. This is the *globalization stage*.

However, whether Chinese companies keep on significantly growing and leading outside their home market will largely depend on whether they turn into genuine sustainable innovation leaders rather than

followers. Now they have gained a notable footage in advanced markets for smart networks and applied artificial intelligence (Lee, 2018), and ahead in 5G technologies and implementations. All the factors are in place.

Disruptive Innovation

If we consider the competitive positioning of high technology firms as a technology race in which falling behind, getting ahead and catching-up in industry leadership is the name of the game. We may come across specific situations that would be connected with 'disruptive innovations' that could lead to a dramatic paradigm shift of that race. The management of disruptive technologies originated with the substantial works by C. Christensen et al.(2004) and C. Christensen (2005).

Disruptive innovations introduce a new kind of product or service that is actually worse initially, as judged by the performance metrics that main stream customers value. In terms of the Chinese market where firms came up with simpler appropriate performance level of network gear at a much lower price for use in rural China those could be identified as disruptive. They also contributed to a *market separation* that distinguished two different tiers of market segmentation applying to rural and urbanized areas. In an industrial organization context incumbents have a high probability of beating entrant attackers when the competition is about incremental innovations, but almost always lose to attackers armed with disruptive innovations (Christensen et al, 2004).. At the bottom line a cumulation of incremental innovations on a particular design may end up in a disruptive innovation as will on the upper end technologically radical innovations . This may lead to market situations and revenue streams of 'winner-take-all' or 'winner-take-most'.

We may categorize two aspects of disruptive innovations that relate to

(1) new markets and (2) quality characteristics.

(1) Products offered are too expensive, too complicated, too difficult too maintain.

(2) Product quality characteristics are appropriate, 'good enough' with significantly lower pricing. New entrants compete profitably , learn and invest in R&D while pricing at deep discounts.

Competitive Phases

In adapting Christensen's theory of innovation to the Chinese telecom industry we may distinguish clearly competitive phases such as separation('isolation' as Christensen's term), convergence and disruption. These phases seem to be more technologically motivated through innovation but may be supported by strategic

direction or other factors.

In a competitive separation (isolation) regime technologies do not interact (in terms of being replaceable) in the course of their development.

Summarizing Remarks

This case study is of interest as a general attempt in identifying Chinese efforts on innovation at the interface of culture, politics, technology and industry. The subject is so complex that it is unlikely to find a consistent interrelated interpretation of innovation with 'Chinese Characteristics'. (The well known Japanese growth economist Michio Morishima in the 1980s did this for Japan (CUP) and ended up with a taxonomy which yet failed to provide a consistent interpretation of Japanese innovation) In my brief comments I limit myself on a case study based Chinese high technology industry

To substantiate some of the claims on industrial innovation one needs a set of industry specific case studies such as the one submitted (A Tale of Innovation and Competition in the Chinese Telecom Industry) . A few remarks are in order.

Chinese advanced technology and science based industries tend to be biased toward" product innovation through commercialization" --- quick market access and then incrementally improving product performance (quality) in subsequent releases.Indigeneous innovation could also involve 'rapid prototyping' in intentionally or inadvertently bypassing IPRs in favour of quick market introduction. Indigeneous innovation could also be a camouflage word for nurturing Chinese startups (where state directed subsidization acts as the equivalence of private sector venture capital or angel investment), and shielding them from foreign competition (at least in the domestic market for a while) in support of 'infant industry' protection and expansion. This is coupled with state sponsored private entrepreneurship with encouragement of Schumpeterian entrepreneurship as examples in the Chinese network equipment industry clearly show. Competition in the Chinese domestic market among indigeneous firms could be fierce and adopts characteristics of a 'technology race' but since the domestic market is so large and with rising incomes demand growing in leaps there sometimes is a lack of incentives to go for global markets (with some notable exceptions outlined by industrial and development policies).

Chinese innovation resembles a 'learning-by-doing' (Arrow) effect as the Japanese have done over several decades whereas the Chinese have accelerated this process by choice and through competition. Indigeneous innovation through domestic competition may limit market risk and therefore protect the

company against total financial failure (bankruptcy). By industrial policy targeted companies can experiment on product development without severe downside risk. You don't bet the company if the product fails in the marketplace, therefore you can come up with incremental changes, whether true innovation or not, and let the market decide in the Chinese seller's market without fearing drastic financial penalties. No Western companies can take these (financial) risks in their domestic markets besides being blocked by Chinese entry barriers(reinforced by Chinese regulation)

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