Thailand Hard-disk drive industry: impending challenges and opportunities on the horizon

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**Highlights**

- Global hard-disk drive (HDD) consumption is likely to decline further due to falling demand for computers, the key market for HDDs. To make matters worse, solid-state drives (SSDs), lighter in weight with swifter data access speeds, are fast becoming a more popular choice, thus KResearch projects skyrocketing annual growth of 34.2 percent for them through to 2017.

- However, the evolution of cloud computing and the general “Internet of things” trend has augmented demand for enterprise data storage, consumer electronics as well as other electronic equipment for daily use. KResearch has assessed that since the Thai HDD outputs are presumably destined for computers, where demand is on a downswing, we believe it would be better for Thai assemblers to concentrate on enterprise and consumer electronics HDDs. That would allow Thai factories to respond better to global HDD demand.

- KResearch estimates that HDD shipments from Thailand in 2015 will be around 175.9-181.8 million units, representing 2.8-percent contraction to 0.5 percent growth, versus 2014 when outbound sales plunged 6.1 percent to about 180.9 million units.

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Thailand has been one of the world’s foremost manufacturing bases for HDDs, with the 2014 trade record showing Thailand as having a 30.1-percent market share on 180.9 million HDDs exported, second to China where exports totaled 35.2\(^1\) percent. However, since the Thai HDD manufacturing is mainly for personal and laptop computers, the Thai HDD industry is now challenged by lower demand for these devices, due to changing consumer behavior favoring portable devices, like smartphones and tablets. By contrast, demand for HDDs in the enterprise market and from online entrepreneurs is soaring. Nonetheless, advanced data storage technology, like SSDs which are lightweight and provide much faster data access than HDDs, is

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\(^{1}\) Projected by KResearch
more suitable for other electronics products, aside from computers. Even though SSD storage is more expensive and contains smaller storage capacity than HDDs, SSD development has accelerated to become a significant rival to HDDs.

Declining HDD exports from Thailand are reflected through dwindling global demand, which is likely to contract at an average 2.1 percent annually in the next four years. Despite the traction from demand for enterprise HDDs and consumer electronics HDDs, orders for computer HDDs — the largest market among the three classes — have declined considerably.

As consumer behavior is changing and data storage technology is more advanced, Thailand’s HDD industry finds it necessary to adjust strategies to seek new opportunities in the enterprise and online service markets, where HDD consumption is increasing. Additionally, Thai HDD manufacturers may need to review their current roles and business boundaries, which restrict manufacturing to computer HDDs, in order to shift to data storage devices for consumer electronics products. In-depth understanding of current and future trends is necessary for such adjustments to devise the most suitable plans and be prepared in both the short and long term.

Cloud Computing boosts demand for HDDs, offering high storage capacity for enterprise and online service markets

The present-day business operations have become increasingly complex, creating ‘Big Data’ — massive data sets, coupled with an appetite for instant access to vast amounts of information, anytime and anywhere. As a result, organizations have increasingly opted for ‘cloud computing’ — the information management technology via internet networks. Cloud providers have applied technological advancements to providing various online services, such as social media applications, movies and music streaming, as well as cloud storage services. Enterprise
customers are also increasingly using virtualized infrastructure for data storage, instead of investing in their own on-premises data center. Meanwhile, ‘personal cloud’ has become popular among internet users, as this type of digital content storage allows netizens instant access to their information securely and conveniently.

The above-mentioned trends of investments and cloud computing services have driven demand for gigantic data storage and reflected an expansion in enterprise HDD consumption. HDD technology is still favorable in this market as HDDs offer high storage capacity at a much lower cost, compared with other various data storage management technologies. Consequently, global demand for enterprise HDDs is likely to rise 8.1 percent annually\(^2\) and reach 93.1 million units by 2018, from 72.3 million units in 2015.

The data storage market has seen rising competition, as a result of technological developments in SSDs — data storage device built on flash-based memory technology. SSDs are well-known for superior aspects — speedy data processing, low power consumption and longer durability — compared with HDDs. However, HDDs remain superior, in terms of economies of scale; with the same storage capacity, SSDs are USD3 more expensive than HDDs\(^3\). Moreover, HDD storage capacity has been increasing consistently, much greater than SSD’s current largest capacity for data storage\(^4\). However, flash memory and SSD manufacturers expect the price and storage capacity gaps between SSD and HDD to gradually decrease to almost disappear by the end of the decade because of rapid developments in flash memory technology.

SSD consumption has been increasing as computer manufacturers, especially for the production of ‘Ultrabooks’ — compact and lightweight laptops, have been using SSDs for data storage component, instead of HDDs. Although storage space of SSD installed in an Ultrabook is smaller than HDD’s, cloud computing has decreased the necessity of having large storage capacity assembled in a computing device. Additionally, Ultrabook users can always connect portable HDDs to their laptops for a convenient storage management of larger data input.

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\(^2\) In reference to Technavio, a leading market researcher in technology.
\(^3\) Estimated by Gartner (October 2013)
\(^4\) Presently, HDDs contain 10TB (10 TeraBytes) of storage capacity at most, while highest storage capacity contained in SSDs are around 4TB.
Due to the aforementioned factors, global demand for computer HDDs will largely decline further, contrasting with demand for computer SSDs that is likely to accelerate to reach 227.1 million units by 2017, or around 60.0 percent of total computer HDDs in the same year.

For computer HDDs, Thailand’s production of 2.5-inch form factor for export is generally higher than the 3.5-inch format. KResearch estimates that 108.6 million units of 2.5-inch HDDs were manufactured in 2014, accounting for 60.0 percent of all domestic HDD manufacturing. The 2.5-inch format is used in laptops as the main data storage component; however, these memory units are being directly affected by rising SSD consumption for computers and a wider spread of portable electronics devices. Since computer HDD consumption declines, in line with Thailand’s falling HDD exports, KResearch assesses that Thailand’s HDD industry has been overly focused on manufacturing and exporting computer HDDs. On the other hand, HDD manufacturing for enterprises, which primarily consume the 3.5-inch format (for which global demand is surging), represents a mere 30.0 percent. Thailand should step up the 3.5-inch HDD production in order to accommodate such growing consumption.

Thailand’s HDD manufacturing industry may appear to have lost its competitive edge, due to changing technological trends and
sluggish global market in general. Nonetheless, HDDs remain the primary memory component in enterprise storage markets; despite rising competition from enterprise SSDs whose expansion rate is greater, organizations still prefer data storage units that offer larger memory capacity and faster data processing. Although HDDs have lost market shares in computers and portable electronics devices to SSDs, HDD storage capacity development continues to progress. Newer HDD models are filled with helium (helium HDDs), replacing the air in the hard drive to reduce friction, temperature and energy use when spinning; the helium-filled HDDs are also proved to boost storage density. Moreover, new technological developments in data storage on rotating magnetic disks, such as Shingled magnetic recording (SMR) and heat-assist magnetic recording (HAMR), may help HDD data storage to grow exponentially in the future, reinforcing HDD strengths to maintain their enterprise market base. For these reasons, it is necessary that Thailand ramp up research and development, as well as investment in such technologies, in order to accommodate demand for high-capacity data storage in the enterprise markets, which keeps on rising.

In the medium term, Thailand must focus on solid-state hybrid drives (SSHDs), combining HDD and SSD technologies to create a storage device that provides larger storage capacity and faster processing. In general, SSHDs may process more slowly than SSDs since only a few SSD components are installed; however, the storage capacity and price range are equivalent to those of HDDs. KResearch views that SSHD manufacturing is conducive to Thailand’s supply chain as HDD components utilized in SSHDs have already been manufactured domestically, which include HDD rotating disks, spinning disk motors and read heads, etc.

The ‘Internet of things’ — connectivity of communication devices/things on internet infrastructure — are clearly exhibited in electronics equipment, such as wireless printers, game consoles, smart TVs, etc. Internet technology has extended into the realm of smart devices and appliances, e.g., ‘internet refrigerators’ that have sensor program to check food types and quantity, as well as other products that are not directly related to electronics or computer industries, such as smart wear in the form of remote-workout apparel that enable trainers to monitor clients’ training performance from a distance.
It is estimated that the ‘Internet of things’ market value will rise to USD7.0 trillion by 2020, compared with USD1.9 trillion in 2013, while internet-embedded devices of all types will expand to 32 billion units by 2020, growing 46.0 percent annually when compared with 2013. Internet-connected daily consumer products are likely to accelerate, surpassing computers and portable electronics devices by the end of this decade.

Once devices using the ‘Internet of things’ increase in number, data transmission between these mediums will inevitably surge. As a result, it is necessary to have adequate storage management to accommodate the inexorable vast amounts of data. KResearch has projected that the ‘Internet of things’ will create new markets, requiring data storage devices, besides the current main markets, which are computers, portable electronics devices and enterprises.

Ones of the main markets that have already adopted the ‘Internet of things’ trend are consumer electronics devices and electrical appliances. The growing popularity in this trend is in line with leading organizations’ business plans, by which companies are preparing their products to be compatible with internet connectivity by 2020. It is, therefore, safe to say that these products will become the main market for data storage devices in the future. The growth trend in this market can be seen in continuous expansion for consumer electronics HDDs, which has been boosted by promising developments in closed-circuit television (CCTV) and the automotive industry, as well as smart TVs which have local storage drives installed. Global demand for consumer electronics HDDs will reach 61 million units in 2015 and will increase to 75 million units by 2018, expanding 6.2 percent annually. In KResearch’s view, HDDs for consumer electronics products will remain highly competitive and will be able to integrate with the ‘Internet of things’ development in a short period of time. Comparable to enterprise HDDs, Thailand’s HDD industry may concentrate on manufacturing HDDs for the consumer electronics market, in order to withstand declining demand for computer HDDs in the global market. If our HDD industry can adapt swiftly in time to cash in on the rise in consumption of enterprise and consumer electronics HDDs, KResearch expects that Thailand’s HDD exports will reach around

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1 In reference to IDC and Gartner, leading market researchers in technology.
2 According to MIT Technology Review, products for daily consumption that have never been connected to internet networks will become the product category with the highest rate of connectivity to ‘Internet of things’ and will contain the highest market share in the global market, compared to the combination of computers, laptops, tablets and smartphones.
3 In reference to Technavio, a leading market researcher in technology.
175.9-181.8 million units in 2015, growth ranging from -2.8 percent to +0.5 percent, from the 180.9-million outbound shipments, or a 6.1-percent contraction in 2014.

In spite of the ‘Internet of things’ trend and rising demand for larger data storage, HDDs may not be suitable for all devices aiming at internet connectivity. This is because products for daily use are compact in design, so they are portable or can be installed with relative ease. They are also intended to carry out speedy processing and interconnectivity. Moreover, since these devices are only required to temporarily store data, while primary information can be stored and retrieved on cloud computing, huge data storage may be redundant. As a result, product size, durability and rapid data processing are the main requirements for data storage units in these items. It is conceivable that, in the long term, flash memory units like SSDs are likely to be embedded into devices used for internet connectivity more efficiently.

In light of advancing technology in data storage like SSDs in the main HDD markets and in devices enabling internet connectivity, we at KResearch assess that it is necessary for Thailand to adapt manufacturing strategies from mainly producing HDDs towards a greater variety of data storage mediums, in order to accommodate diverse demands for data storage in the global market, as well as buffering the risk of saturating HDD consumption in the enterprise market and consumer electronics products.

Manufacturing components and assembling SSDs should be the main goal of such strategies. Although multi-national organizations host SSD assembly lines in Thailand, KResearch believes that the SSD manufacturing capacity is still limited, as Thailand remains a mere assembly contractor, due to obstacles preventing access to advanced technology in domestic supply chain. Particularly, Thailand continues to rely on imports of NAND flash memory, which is the main component of SSDs. In fact, SSDs manufactured in Thailand require NAND flash memory from SSD or flash memory manufacturers which do not have an assembly line in Thailand. Moreover, Thailand’s HDD industry still lacks upstream manufacturing, such as electronics design and development of semiconductors, which are necessary for better access and understanding of flash memory technology. To make matters worse, Thailand is short of a workforce skilled in design or research and development, which are necessary for designing upstream electronics components, such as integrated circuit boards, waferboards and printed circuit boards. The aforementioned counterproductive factors have caused Thailand’s HDD industry to fall behind in the SSD manufacturing development.
On a brighter note, our HDD industry’s attempts to make a shift to new data storage technology is slated to be supported by the Board of Investment (BOI)’s new promotion plan, which is focused primarily on offering special privileges to businesses related to electronics design, high-technology manufacturing of wafer boards, SSDs and HDDs, as well as components of these data storage units.

KResearch considers that flash memory technology is essential for our long-term competitiveness. Therefore, investment promotion planning and policies for efficient human resources development, coupled with efforts to extend technology development by domestic manufacturers with a focus on enhancing our personnel’s technical skills, will bring about the development and establishment of flash memory assembly lines in Thailand. These efforts will create domestic supply chains that fortify potentials and ready our data storage industry overall for SSD manufacturing in the future.

Although Thailand may be successful in attracting investment for shifting from HDD to SSD manufacturing, we should not forget that data storage technology keeps innovating. For example, phase-change memory (PCM) and Magneto resistive random-access memory (MRAM) are at the research and development stage, and are expected to replace SSD. As a result, SSD technology is at risk of becoming obsolete. Moreover, as Thailand is still dependent on overseas technology and investment, we may be re-challenged by the same old problems that occur to the HDD industry. For these reasons, research and development for upstream technology is the key for Thailand to keep up with rapidly progressing technology. Furthermore, to make progress in a value chain, the government sector, educational institutions and businesses in the private sector should join forces to develop an initiative, which still requires greater driving force ahead.

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