



## The Great Leap Forward

Weebit Nano (ASX:WBT) is rapidly moving closer to the commercialisation of its technology – potential delivery of SiOx-based ReRAM memory modules for a South Korean company before the end of 2020. Recently, WBT also attained external verification from memory chip manufacturer XTX Technology in China, four months ahead of schedule. This has cleared the path for WBT to push forward its entry into the discrete memory market.

The company also just signed and LOI with SiEn Integrated Circuits in China to deploy SiOx ReRAM technology into SiEn’s semiconductor products.

Such industry acceptance for WBT’s technology should drive commercial traction in the near term, in our view. In turn, we expect this to drive up the share price from the current levels.

### Moving into discrete memory earlier than planned

The verification of WBT’s technology by XTX led to an early entry into the stand-alone, or discrete, memory market. Previously, WBT had planned to enter this vertical at a later stage, but the market’s need for discrete memory solutions (as highlighted by XTX) led WBT to rework its timeline. We believe this provides a huge potential growth opportunity to WBT, as it can start to build presence across both the discrete and embedded segments of the non-volatile memory (NVM) market.

### Leti studies deliver further positive news

Following the latest results from tests conducted with Leti, WBT is progressing well on refining its technical specifications and production processes. Recent findings confirmed the previous hypothesis that WBT’s ReRAM technology can be produced using only two (or possibly one) additional masks. Compared to other technologies, this translates into substantial cost advantages for chip manufacturers. In our view, this development could lay the groundwork for a major boost to WBT’s adoption rates.

### Reiterating valuation of A\$1.65 per share

With external verification of its technology, alongside the expected delivery of its first memory module before the end of 2020, we believe WBT is on the fast-track towards commercialisation. Moreover, the continuous refinement of its technical parameters, the potential to secure patents for its IP, and early entry into the discrete memory market lend strong fundamental value to the company, in our view. As a result, we continue to see robust upside potential and reiterate our valuation of A\$1.65 per share.

Share Price: A\$0.355

ASX: WBT

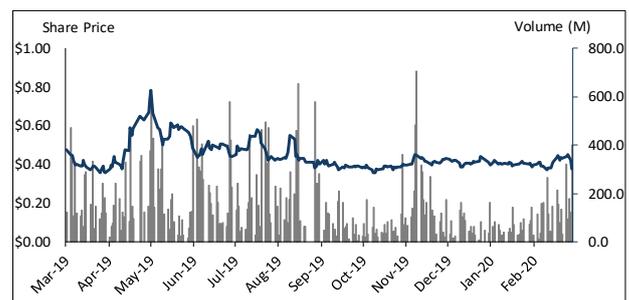
Sector: Technology Hardware & Equipment

3 March 2020

Market Cap. (A\$ m)	25.5
# shares outstanding (m)	71.9
# shares fully diluted	82.1
Market Cap Ful. Dil. (A\$ m)	29.1
Free Float	100%
52-week high/low (A\$)	\$0.82 / \$0.355
Avg. 12M daily volume ('1000)	150.4
Website	<a href="http://www.weebit-nano.com/">www.weebit-nano.com/</a>

Source: Company, Pitt Street Research

### Share price (A\$) and avg. daily volume (k, r.h.s.)



Source: Thomson, Pitt Street Research

<b>Valuation metrics</b>	
Fair valuation (A\$m)	135
Valuation per share (A\$)	1.65

Source: Pitt Street Research

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## SiOx ReRAM moving closer to commercialisation

Weebit gave the market an early Christmas present in the form of external verification of its SiOx ReRAM technology by XTX Technology. XTX is a memory solutions provider based in Shenzhen, China, offering Flash-based NVM solutions to a client base of c.2,000 customers.

In a bid to commercialise its proven technology, WBT had signed a letter of intent (LOI) with XTX in August 2019, to explore the possibility of integrating WBT's technology in XTX's products. To achieve this, a joint team of WBT's and XTX's engineers tested and successfully verified the technical parameters of wafers of WBT's SiOx-based ReRAM technology. The tests were conducted at XTX's facility in Shenzhen and successfully completed four months ahead of schedule. While no payment was made by XTX, the company invested two weeks of expensive lab time on this project, which we believe speaks volumes in itself.

The tests were able to reproduce the results regarding endurance and retention levels, previously achieved by Leti, WBT's French development partner. This brings WBT a substantial step closer to commercialising its ReRAM technology by providing the potential to integrate ReRAM in XTX's Flash memory solution. XTX is currently focussed on discrete memory chips, which has translated into an early entry opportunity for WBT in the discrete memory market. XTX's verification also helps WBT in its discussions with other potential customers.

*External verification by independent memory solution provider puts WBT ahead on its commercialisation curve*

## Using the Leti relationship for the discrete memory market

WBT had previously slated the entrance into the discrete market segment for a later stage. However, due to the interest shown by XTX and other potential customers, WBT is now hitting the accelerator to expand into this lucrative segment. Having a customer at the end of the development cycle to take up the new solutions developed by a start-up is a huge plus for the company. Since WBT has already secured an interested client in XTX, we believe the company has a huge advantage over other technologies.

However, discrete memory chips have a long development cycle due to the requirement of a specialised selector. A selector is a key element in discrete memory chips that helps isolate only specific memory cells for rewrite without disturbing others. In contrast, Flash memory has to read a whole block, update the requested bits and then rewrite the whole block, even if it is to write just 1 bit of memory. This is what makes ReRAM 1000X faster and 1000X lower power than Flash memory.

While WBT uses a, relatively large, transistor as a selector in its embedded memory solution where size is much less of an issue, it cannot use a transistor for discrete memory modules. Since discrete memory chips are very densely packed with memory cells, a transistor-based selector would be disproportionately large, and negate most of ReRAM's advantages. A small selector is, therefore, crucial for discrete memory chips.

## Leti has a had a selector in development for several years

Development of a selector is a very long and difficult process. WBT, however, has the advantage of leveraging on its partnership with Leti, its French research partner, which has been engaged in the development of a selector for several years. To this effect, WBT has announced a new three-stage programme for the development of the discrete memory solution. The first

*Interest shown by XTX allows early entry into the discrete memory domain*

*Partnership with Leti to catapult the development of ReRAM cell for discrete memory market*



stage is where specific details of the selector are defined, which will last for three months. The remaining two stages involve compatibility testing of ReRAM and the selector, which will go on till mid-2021.

## Expanding across the NVM market

It is noteworthy that the work on both the embedded and discrete memory solutions would occur simultaneously. WBT plans to transfer its embedded memory technology to a production fab by December 2020 and reveal its ReRAM cell for the discrete memory market by mid-2021. In our view, this is a substantial growth opportunity for WBT, as it can now address both the embedded and discrete segments of the NVM market. As per a report by MarketsandMarkets, the NVM market is expected to reach US\$82bn by 2022, growing at a CAGR of 10% over 2017–2022.

## Market opportunity in China is huge

We believe that with WBT's ReRAM technology receiving verification from an independent external facility, it is well positioned to attract the attention of Chinese memory solutions providers. China has a robust semiconductor industry, which is set to reach US\$129bn in revenue in 2020. Moreover, China is a major consumer of semiconductors, accounting for 41% of the global total in 2018. As per a report by Deloitte<sup>1</sup>, China is set to constitute 57% of the global semiconductor consumption by 2024. Further, the LOI with XTX provides WBT the potential to cooperate with the memory chip provider on sales and marketing activities in the country. We believe this signals a substantial growth opportunity for WBT in the Chinese NVM market.

## Update on production of memory module

With external verification at the centre of its focus, WBT's timeline for memory module got pushed back. WBT had originally planned to deliver the product to its potential first customer, a South Korea-based technology company, by mid-2020. Now the company expects to make the product available to its first prospective customer by end-2020.

The customer is a tier-2 provider of SoC development and design services with its own manufacturing facility. Once the product is delivered, WBT expects to leverage the work done for the Korean partner to secure further client engagements in the region. This will be driven by the configurable nature of WBT's module, which will allow it to be adapted to fit the specifications (size and shape) as per the designs of potential customers' product.

Notably, South Korea is the largest memory chip manufacturer in the world, accounting for c.57% of the global supply. In our view, leveraging off the strong connections of Kitec Design, its semiconductor distributor in the region, WBT is well poised to take advantage of this growth opportunity.

## Leti confirms efficiency of WBT's technology

Latest tests conducted by Leti confirmed that WBT's ReRAM technology can be produced as embedded memory using two (or possibly only one) additional masks. This is significantly lower than the 7–10 additional masks needed for the current Flash memory. In our view, this reduction in mask rate

*Extended focus on external verification by independent memory solutions provider the sole reason for delay in productisation*

*Reduced mask numbers will likely offer significant cost benefits to WBT's customers*

<sup>1</sup> "Semiconductors – the Next Wave" (April 2019)



presents a crucial advantage for WBT to secure work with prospective clients. As semiconductor memory device manufacturers move down to smaller geometries (potentially below 28nm), the cost of the required mask set can reach millions of dollars. Therefore, the implementation of WBT's technology is expected to provide substantial cost benefits to its clients. We believe this should fuel the adoption rates for SiOx ReRAM, as it offers its customers a significant value-add in terms of improved margins.

## Studies also reveal potential for improved production yields

WBT's technology has potential for further positive impact on customers' bottom lines, as validated by results from the second study conducted by the Weebit-Leti team. The second study revealed that production yields (number of working dies per wafer) can be improved by using novel methodologies. The report provides ways for semiconductor manufacturers to avoid or fix the malfunctions that arise during the production of ReRAM devices. This provides a critical advantage to customers by allowing them to reduce the error risk in their production process. In our view, this is expected to drive the adoption of WBT's technology.

*Increased production yield to provide substantial incentive for customers to adopt WBT's technology*

## Interview with CEO and Chairman



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## New, high profile, collaboration in China

In addition to the news of accelerated development of discrete ReRAM applications, WBT very recently announced it signed a Letter of Intent with SiEn Integrated Circuits (SiEn), founded by Dr. Richard Wang, a high-profile semiconductor entrepreneur. Mr. Wang founded one of China's largest foundries, SMIC, as well WSMC, which was later sold to the world's largest foundry, TSMC in Taiwan.

The key objective of the LOI with SiEn is to find common ground with the aim to deploy WBT's SiOx ReRAM technology into SiEn's semiconductor products. SiEn should be getting a 200mm and a 300mm fab online in 2020 slated for production between 18 and 28nm (nanometer) for a range of different products, including specialty memory, logic, DSP, micro controllers and



MEMS. Both fabs are based on STM's technology, which is also used by Leti, WBT's development partner. Consequently, we see good opportunities for some near term design wins with SiEn, potentially resulting in some NRE work and license fees.

## Filed three new patents for SiOx ReRAM technology

Given that WBT has already proven the technical parameters of its technology to the industry, it is now seeking to secure its IP. To this end, WBT – together with Leti – has filed three new patents for its SiOx ReRAM technology. While two patents seek to protect smart algorithms that identify failure modes in the manufacturing process, the third will protect WBT's sophisticated process flow techniques. Notably, these algorithms and techniques provide WBT a competitive advantage in terms of higher production yields and revenue per wafer for its customers.

## Conclusion: The Big Leap Forward

We believe that with WBT's steady progression, the commercialisation of its SiOx ReRAM technology is not too far off. The external validation of its technical specifications and the potential delivery of the memory module before the end of this year push WBT closer to productisation.

Additionally, the continuous technical refinements being made with Leti provide a solid foundation for WBT to build its growth strategy. A potential earlier entry into the discrete memory segment has also exponentially expanded WBT's total addressable market, while the collaboration with SiEn may lead to some near-term design wins in China.

In our view, these developments bode very well for WBT, which we believe is making its Big Leap Forward, presenting a substantial rerating opportunity for the shares. As a result, we reiterate our valuation of WBT towards A\$1.65 per share.

Please refer to [www.pittstreetresearch.com](http://www.pittstreetresearch.com) for our initiating coverage report on WBT, including risk assessments.

## Analyst certification

Marc Kennis, lead analyst on this report, has been covering the Semiconductor sector as an analyst since 1997.

- Marc obtained an MSc in Economics from Tilburg University, Netherlands, in 1996 and a post graduate degree in investment analysis in 2001.
- Since 1996, he has worked for a variety of brokers and banks in the Netherlands, including ING and Rabobank, where his main focus has been on the Technology sector, including the Semiconductor sector.
- After moving to Sydney in 2014, he worked for several Sydney-based brokers before setting up TMT Analytics Pty Ltd, an issuer-sponsored equities research firm.

In July 2016, with Stuart Roberts, Marc co-founded Pitt Street Research Pty Ltd, which provides issuer-sponsored research on ASX-listed companies across the entire market, including Technology companies.

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