

# MKW Ventures Consulting, LLC

## Overview Q4, 2016

Mark Webb

Confidential: Not for distribution

# Experience

- Mark K Webb is Principal of MKW Ventures Consulting LLC
- 23 Years at Intel Corporation and IM Flash Joint Venture with Micron
  - Fab Manufacturing, System Manufacturing, Device Engineering, Product Engineering, Q&R Engineering. Flash, Logic, Communication technologies
  - Promoted from Individual contributor/Staff Engineer to Manager to Director level
  - Most recent: Manufacturing Director for Intel NVM solutions Group, Product Engineering Manager for IM Flash JV reporting to Senior VP or Officer
- Left Intel in July 2012, Started consulting business
- Focused on NAND cost, New NVM cost and product roadmaps, SSD System Manufacturing, SSD Product roadmaps, SSD Market analysis.
- Clients (direct/indirect) have been SSD OEMs, SSD ODM/CM, NAND manufacturers, Storage/HDD companies, Investment Firms
- Industry Contacts (monthly contact/exchanges) include
  - Senior Engineers and managers at multiple NAND manufacturers
  - Engineers and Managers at Logic manufacturers,
  - Leading memory/SSD/Semiconductor industry consultants and analysts
  - Engineers and directors at multiple ODMS/CMs/OSAT manufacturers.
- Mark's Experience and knowledge of NAND costs, SSD costs, SSD Manufacturing is industry leading. Differentiator is actual data vs. guesses

# Q4 2016 Focus Areas

- SSD market analysis
  - BGA SSD markets, costs, and adoption rates
  - HDD company positioning in market
  - Market penetration/acceptance and tipping points
  - Costs for 2.5", M.2, and BGA SSDs on all interfaces
- NAND costs and technology. Industry recognized expert
- 3DXP and new NVM costs and revenue projections
- SSD interface roadmaps and form factors
- Logic (IDM and foundry) and Memory Fab wafer and unit costs
  - SOC costs, pricing, technology node roadmaps
- Presented multiple papers on NVM/NAND at annual FMS
  - Leading edge predictions on SSD, NVM, and NAND roadmaps each year

# Q4 2016 Reports/Analysis

Specifics available to Clients

- SSD Market Analysis
  - SSD Revenue MSS for Client, Enterprise. Strengths, Weaknesses by company
  - NAND supplier vs HDD supplier business models
  - SSD density and unit shipments
  - Volume by interface and Formfactor and tipping points
- NAND Market
  - Current and modeled costs over time for industry and major suppliers
    - Wafer, assembly, test cost breakout
    - Quantitative Impact of different quality levels, screening, ECC/overprovisioning
  - NAND supplier models for dealing with customers, lead times, pricing
  - Fab start up costs, depreciation models, fixed and variable costs
- SSD Cost Analysis
  - Enterprise vs Corp Client vs performance consumer vs consumer
  - Real life examples

# Potential Opportunities

- **NAND cost modeling, Margins, DRAM exchange pricing vs actual unit cost.**
  - Prices vary widely for higher quality levels, although cost can be similar.
  - Predictions and implications of 3D NAND ramp
  - End Result: how much should we pay for NAND?
- **Supply agreement options with current and alternate companies**
  - End Result: How can we add or modify agreements to better support future options
- **SSD manufacturing costs and factory assessments.**
  - Benchmarking of Internal factories for multiple NAND players and 5+ ODMs gives perspective
  - Extensive knowledge of ODM costs and margin models for very inexpensive client SSD cards to very expensive enterprise solutions.
  - Test system benchmarking for quality and throughput
  - End Result: How do our factories compare to competitors and if we outsourced manufacturing
- **Can we add “ODM in” SSD designs to our portfolio**

# Data Available

DATA	2016	2017	2018	2019	2020
NAND Cost per GB (for each vendor)					
Enterprise SSD costs (NVMe, SATA, SAS)					
Client SSD Costs (performance)					
Client SSD Costs (Consumer)					
SSD Market Penetration (Client)					
SSD Market Penetration (Enterprise)					
3DXP Cost, Performance, Revenue					
RRAM Cost, Performance, Revenue					
SOC costs for IDM and Foundry					

**The key is not only the data above but keeping it updated in this fast changing market and checking milestones and potential tipping points**

# Follow Up

- Let us know how we can help your company
- Multiple business models available
- First meetings and discussions are free

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