Volume Skews Smart Phone Leaders

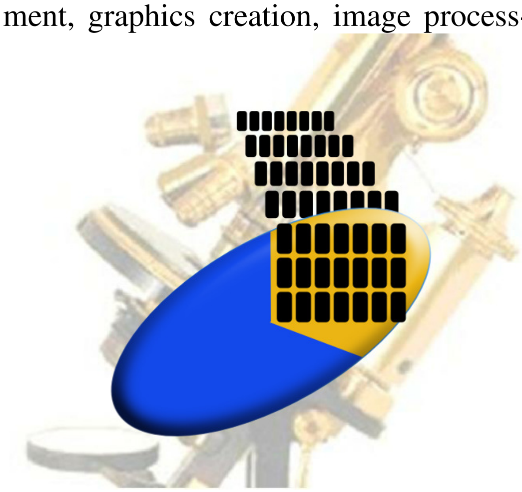
It takes 25 times the models to put Samsung ahead of Apple

Variety may be the spice of life but in business it can work against profitability. The variety of cell phones models being sold by leaders Samsung and Apple reveals very different approaches to their business. Apple is highly focused while Samsung is all over the map. The underlying semiconductor industry greatly favors fewer chip varieties to capitalize on economies of scale.

Apple has offered no more than three (3) phone models at any point in time, phasing out prior phones almost overnight as the new models are introduced with great fanfare. There are no low-end Apple phones, and they all operate essentially the same way. On the other hand, Samsung has risen through the phone ranks by offering a wide variety of cell and smart phones. Over 150 Samsung models show as active, just in the USA, capped by the Galaxy S series (not all 150 models may qualify to be called "smart"). Current models of wireless phones are given in the tables below.

Apple phones run one operating system, iOS. Samsung phones range from basic flip phones running rudimentary OSs to exotic touch screen handsets running Windows, a homebrew OS, or the 31 flavors of Android. The differences in these OSs are immense even if many user features appear similar enough to justify legal battles.

Looking inside the handsets exposes a similar tale of single-mindedness for Apple and a mish-mash at Samsung. Apple specifically designs its own applications processors (appls processors), the central chip that puts the smart in the phone, executing the reams of computer code that dance between OS management, graphics creation, image processing, music reproduction, email, Web browsing, the hallmark touch screen user interface, and even the occasional phone call. Apple has used its A4, A5, A6, A7 … appls processors in all of its handheld devices.



Samsung products use an assortment of different appls processor chips. While simpler phones need only modest processors, Samsung engages Texas Instruments OMAP, Qualcomm Snapdragon, and NVIDIA Tegra appls processors across its smart phones. Each of these are families of processors, offering different functional capabilities along with their increasing-over-time baseline performance. Perhaps most surprising is that Samsung's semiconductor organization has designed and marketed its own family of appls processors, Exynos, yet Samsung itself has barely started using it in its own handsets (and essentially no other OEM uses it either). While all of the named processor chips are based on ARM core architectures, there is still 90% of these SoCs that are very unique.

Apple handsets were initially available only through AT&T in the United States. Astonishingly, and in testament to the distinction of the original iPhone, this did not limit the sales nor market dominance of the product line. What it did do is let Apple deal with a single network carrier and its air interfaces and one sales channel (later supplemented with Apple Stores and then additional carriers). This eliminated the distractions of reworking circuits and policies for multiple distributors in a multi-tiered ecosystem.

Samsung phones are available through numerous carriers and outlets.

Few vs. Many

The ultimate impact of using few versus many designs is cost. While giving the customer the greatest choice sounds good, this comes at increased cost for design, development, materials, support, manufacturing, inventory, logistics, and overall management. Whether it's grocery store shelf space, automobile color and option packages, or clothing styles, the management of each additional choice can gut profits even if it might seem to sell a few more units.

Table 1. Current Apple U.S. Phone Models

iPhone4s (A5)	iPhone5c (A6)	iPhone5s (A7)

(applications processor noted in parentheses)

Source: Apple Corp.

Table 2. Sampling of Current Samsung U.S. Phone Models

A157	Array	Gravity Q
M370	ATIV Odyssey	Gusto
M400	ATIV S Neo	Haven
R375c	Brightside	Intensity
R455	Caliber	Jitterbug
S125G	Chrono	Messager
S150G	Comment	Mondi
S275G	Continuum	Montage
S380C	Contour	Reality
S390G	Convoy	Replenish
S425G	Denim	Restore
T159	DoubleTake	Rugby
T404	Entro	Smiley
	Focus	Smooth
	Freeform	
Galaxy –		
Admire	Nexus	S II
Amp	Note 3	S III
Appeal	Note II	S III mini
Axiom	Prevail	S 4
Centura	Proclaim	S 4 mini
Discover	Reverb	S 4 zoom
Exhibit	Ring	S Aviator
Exhilarate	Rugby	S Blaze
Express	Rush	S Lightray
Legend	Stellar	S Relay
Light	Stratosphere	
Mega	Victory	
Metrix		

most names are ™ or ®, omitted from table for clarity

Source: Samsung

That's the beauty of computer processors and their infinitely alterable software. A dozen people might buy the same PC and use it for a dozen completely different tasks, depending on the software each runs. Yet rather than building 12 unique boxes, the hardware manufacturer reduced costs by negotiating better pricing on a dozen identical sets of components and learning to build a dozen identical boxes a little bit better.

The software vendor faces a more difficult situation. It may take a dozen different vendors to create the programs for the unique needs of each end user. This carves the market into smaller pieces for the software folks. However, since all those PCs have identical components, some commonality among software vendors may afford advantages in sharing or building on top of one another's programs, even if the end uses are quite different.

Semiconductors and the Law

The industrial revolution took advantage of the uniformity of machine output. Henry Ford made automobiles affordable by dedicating people and machines to a specialized task at which they were able to get extremely good – moving up the "learning curve." Today, semiconductors epitomize true economies of scale like no other industry. While the observation of the trend over time in chip density known as Moore's Law is often misconstrued, its effect is the result of a lot of hard work and advancements in technology that have a remarkable benefit to the functionality – and therefore cost savings – of the next iteration of chips. All of this is driven by volume, be it the mass production of clocks, cars, or electronics. Nowhere has it been more clear that electronics delivers more "bang for the buck" with each passing year.

The ideal semiconductor to manufacture is identical to the last million semiconductors that were manufactured. Material cost reductions, re-use of equipment, and "learning" all contribute to quality improvements and long-term amortization of costs. If the next chip to be manufactured is a little different than the last million, or the same with 25% new circuits, or completely different though vaguely similar, then the learning is proportionately disrupted and cost benefits deteriorate. Semiconductor vendors look for the one chip that will sell billions rather than a thousand chips that will sell millions. It is all an ongoing cost tradeoff business decision balancing time, effort, and investment against sales, market share (or mind share), and profitability. Memory chips epitomize the billions end of the spectrum.

Complexity and Mobile Phone Realities

Smart phones can be viewed as more diverse and complex than a computer. The variety of tasks smart phones perform are extraordinary from "simple" telephony (it isn't) to multimedia capture and re-creation to Internet activities and the open door that "apps" expose – all on an extremely low power budget from a tiny physical space. The software that performs each of these tasks is very sophisticated, and management of the multiple tasks that take place at the same time using common resources is extremely complex. Once the software is mostly right, the last thing a company wants to do is change it.

It is a huge effort to port (convert) that much software to new hardware, exponentially more difficult as the differences increase. Each change, correction, and upgrade to software for one architecture or one chip must be performed for all other chips as well. Each different architecture and chip is likely to require changes made a different way. Revision control, documentation, and long term support are significant efforts as well. Each hardware change magnifies the problem, whether it is a different size/shape/resolution display, touch input, camera (image sensor), position/motion sensor, or image/video/audio/motion accelerator. All changes must be validated across a matrix of hardware combinations, use modes, and time-based multi-tasking/shared-resource scenarios.

It is not unusual for 80% of a system design team to be software programmers with a minority being hardware designers. It is more likely those programmers will be on the job for years after the product is in the market, fixing, reconfiguring, updating, and enhancing features. The cost of these programmers is difficult to assess, and its burden tends to fall on subsequent products for amortization.

Minor Effects

Some features have little real impact on product cost while others are necessary evils. Painting an entire car and coordinating the interior upholstery is a major effort. But whether the exterior case of a phone is black, white, or pebble blue, however, is a last-second decision with no appreciable cost impact. It is curious that a spread of colors for the recent iPhone was news, when most people personalize and protect their phones by throwing on a $5 plastic cover anyway.

Memory choices of 16GB or 32GB require no particular change to the hardware or software, and an express price adder covers the memory differential while giving the user measurable storage benefits.

To enter some markets or geographies, the radio "air interface" and protocol must match the carrier or the country's network standard. This is an unavoidable requirement, so any vendor will need to swap in the right transceiver to serve each market. True software defined radios have difficulty competing with the dedicated approach. The radio modules can be shared across different phones to gain benefits of scale.

A Little Math

In round numbers Samsung sold 300 million smart phones in 2013 while Apple sold 150 million out of a total market of nearly 1,000 million (illustrated in the front page images.) Lower-grade feature phones add 800 million to the total of which 150 million were Samsung's but Apple sells only smart phones.

Apple gets its 15% market share with just three models of smart phones and while Samsung takes 30% of the market, it must produce 150 models of smart phones to do so. Simple division shows that Apple averages 50 MU per handset model while Samsung averages just 2 MU per model. That's a 25x difference! It took 25 times more phone designs for Samsung to sell twice as many units, and the ratio is far worse when non-USA models are added in.

Profitability of the Few

So many factors all point to the same conclusion: it costs less to serve a market with a few robust products than serving it with many products using many components needing many rehashes of software. Judging success by market share does not tell the whole story. As shown, the differences between Apple and Samsung can be striking.

The approach to business that Apple has taken aligns well with the semiconductor industry's principles, scientifically rooted as those are. Yet Apple has also revolutionized products with imaginative innovation, firing up markets that were significant but muddling along. Apple did this with nearly singular products, and when they proved to be successful, it didn't proliferate dozens of similar products but kept focused on extremely few.

Apple's approach has served the company very well. Apple's customers are extremely loyal, and the company's balance sheet would be enviable in any industry.

A person has to wonder how Samsung can be as profitable with 150 phone models as Apple is with just three.

***Tom Starnes**, February 2014*