Market Leadership, Forms of Innovation, & Lifecycle Stage

Wilson Zehr, PhD, MBA

Industry, Engineering & Management Systems (IEMS)
March 16, 2021

What Do These Firms Have in Common?
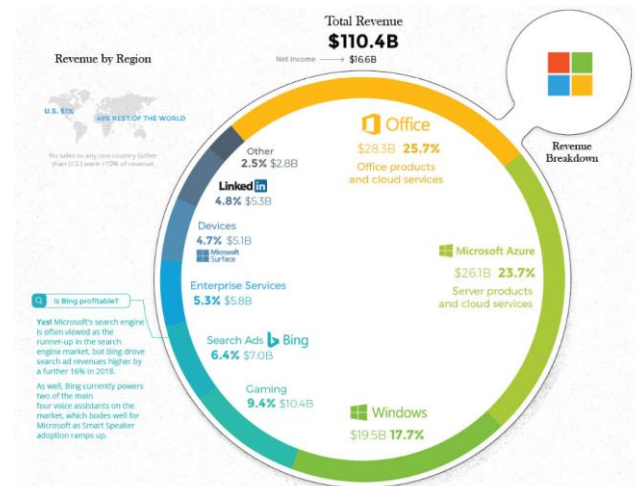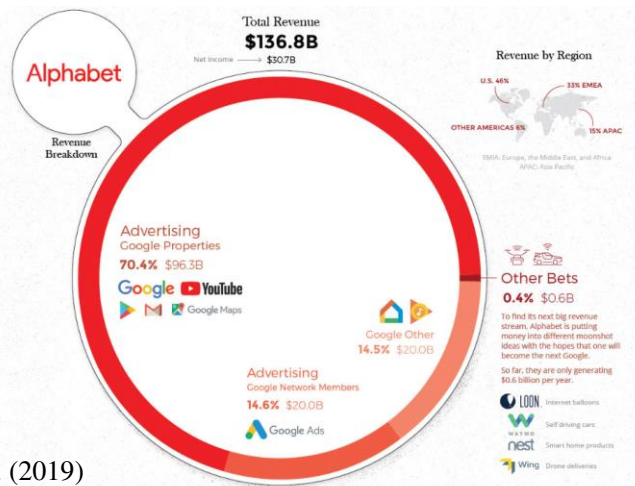
1976

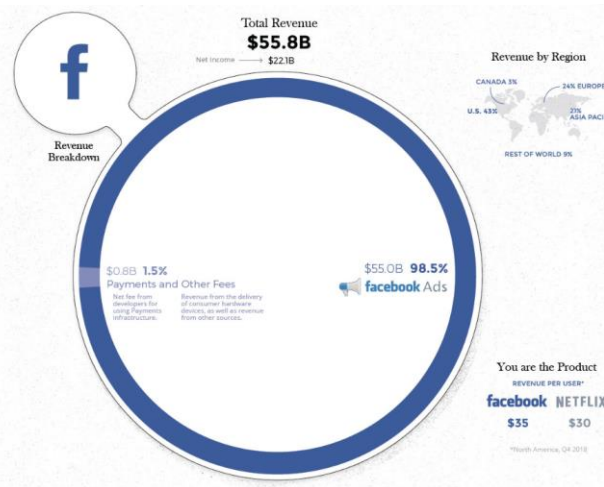2004

1994

Tech Big 5

1998

1975

Did NOT Exist Before 1975!
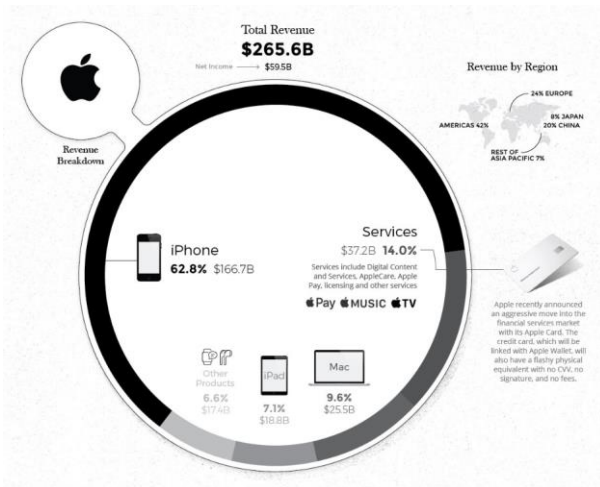
Desjardins, J. (2019)

Innovation Responsible for 80% of U.S. Economic Growth Since World War II (Atkinson, 2011)
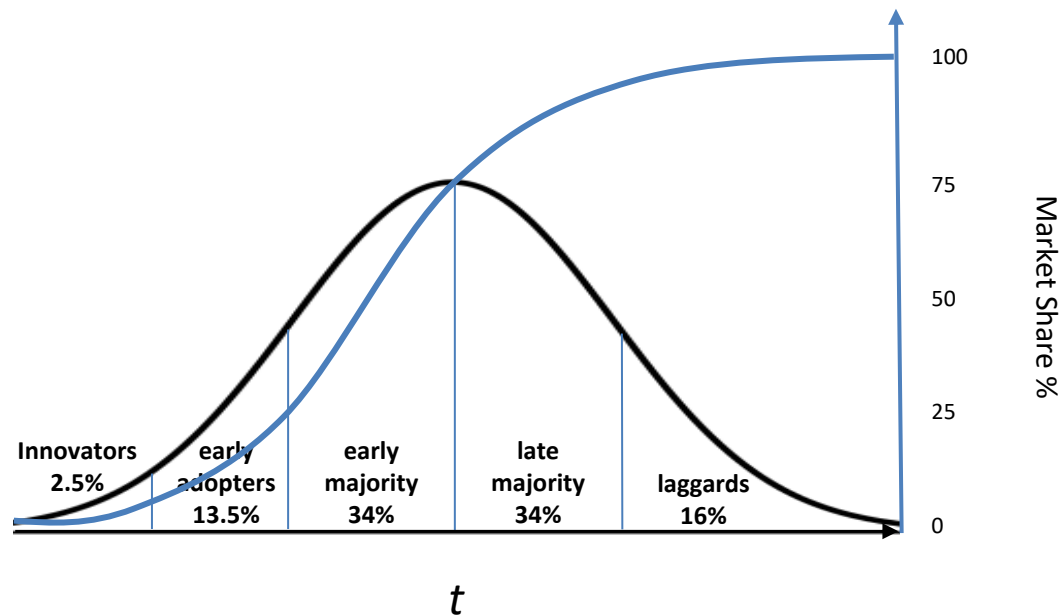
Creative Destruction (Schumpeter, 1934)

Rogers (1962, 2003)

the Chasm

Innovators 2.5% | early adopters 13.5% | early majority 34% | late majority 34% | laggards 16%

Market Share %
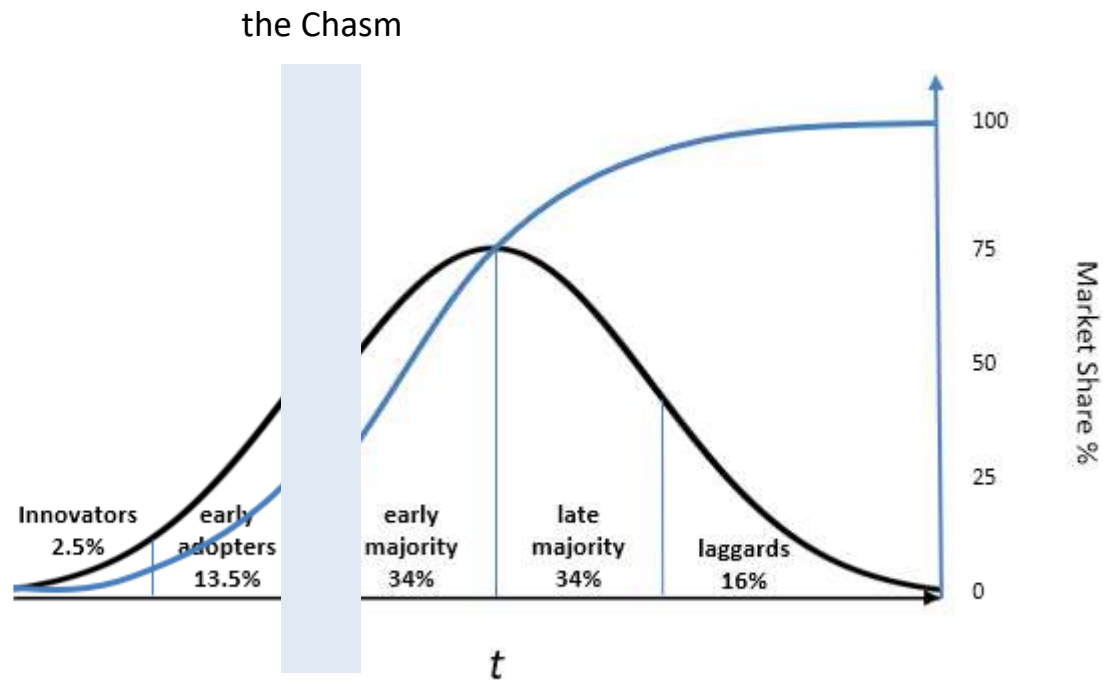
Moore (1991)

No Guarantee….

IEMS Conference
March 16, 2021

Conceptual Foundation
Incremental vs. Disruptive Innovation
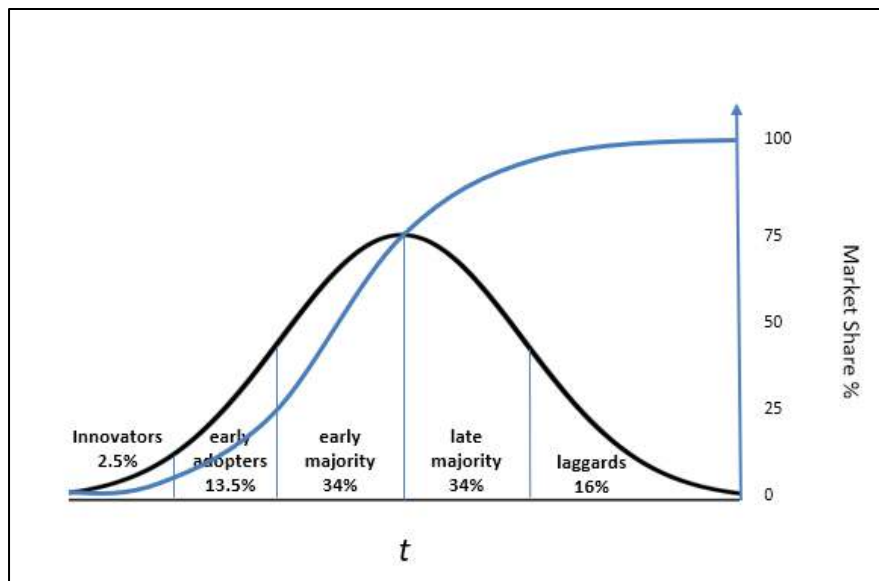
Rogers (1962, 2003)
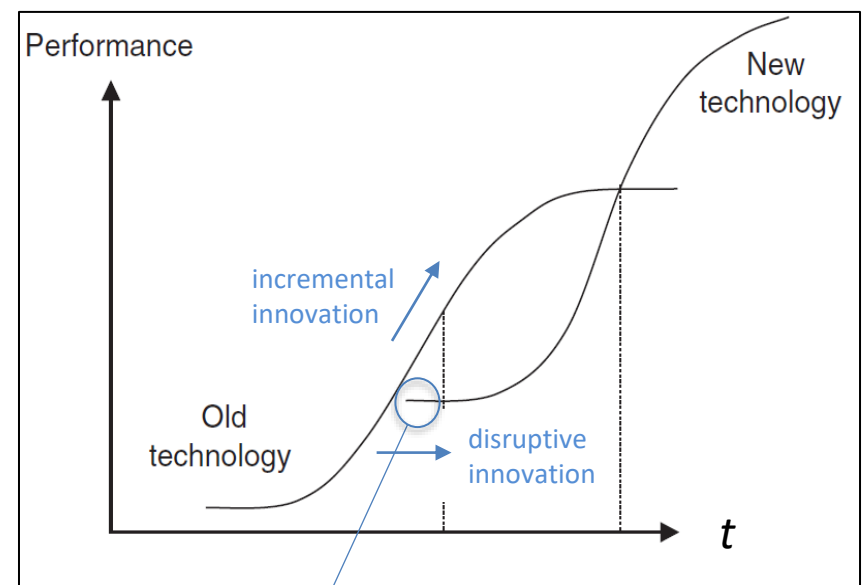
Christensen (1997)
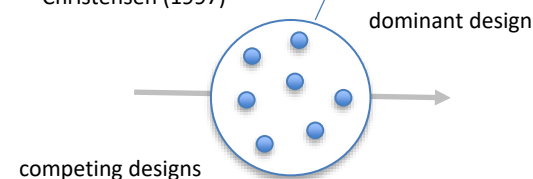
IEMS Conference
March 16, 2021

Conceptual Foundation
A-U Model

High

Rate of innovation

dominant design

product innovation

process innovation

t
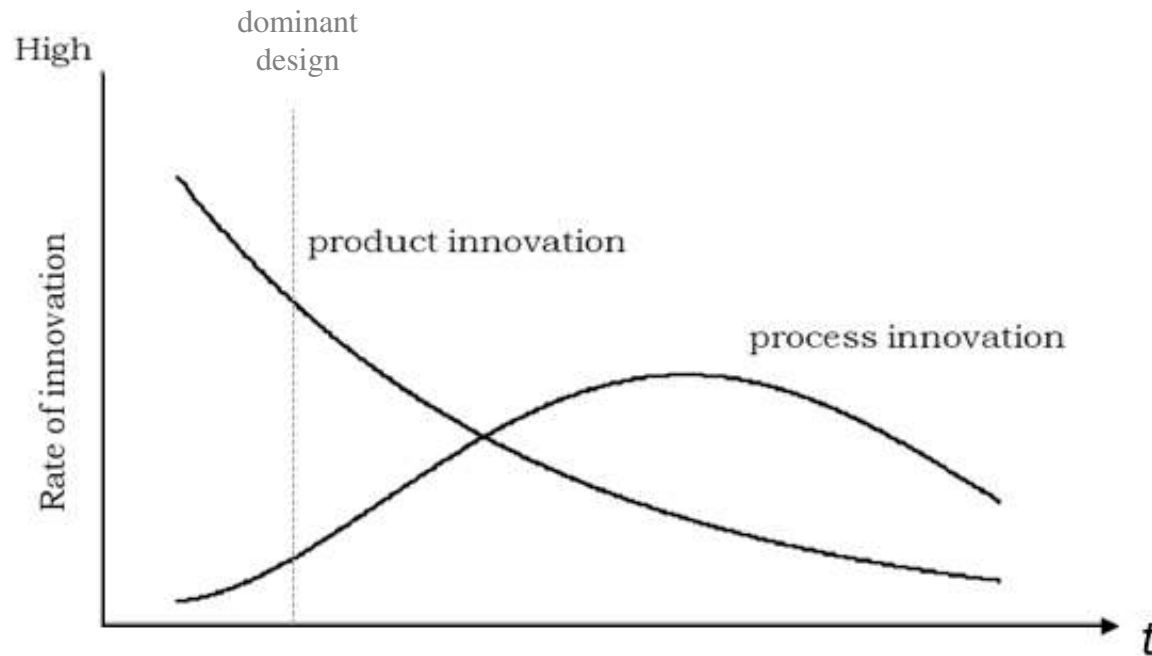
Abernathy & Utterback (1975)
Utterback (1994)

Forms of Innovation

product

process

marketing

organizational

business model

other frameworks...

Problem Statement

The general problem is that there does not appear to be consensus on the form(s) that non-technological innovation can take.

The specific problem is that the A-U model, which guides innovators and researchers (Teece, 1986; Akiike, 2013), does not include forms of non-technological innovation that are generally accepted by experts (OECD, 2018).

These new forms of innovation have been shown to produce returns that are four times larger, and far more sustainable, than traditional product/process innovation (Lindgart, Reeves, Stalk, & Deimler, 2009).

Research Question

What is the consensus of an expert panel of innovators and researchers on the form(s) of innovation that were used by competitors to establish market leadership over the historical lifecycle of a technology industry?

Qualitative e-Delphi process, using an analytical hierarchical process (AHP) decision model, based on 45 years of historical industry results (1975 - 2020).

Build consensus on market share leaders, forms of innovation considered, and form used by each market share leader
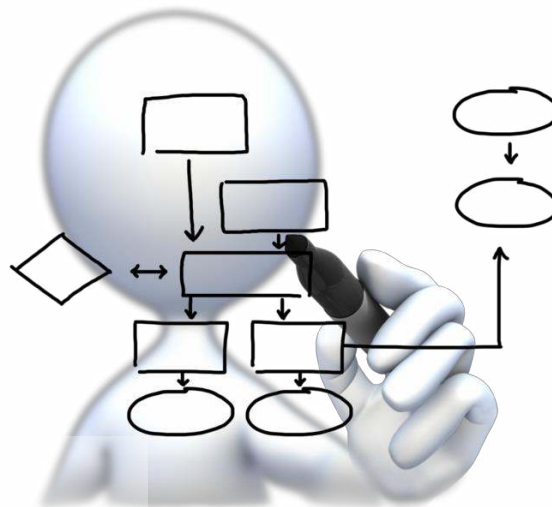
Saaty (1980)

Linstone & Turoff (1975)

Dalkey & Helmer (1963)

- 45 years U.S. PC market share data

- Multiple data sources/sets
  - U.S. PC market share 1980 – 1982 (Steffens, 1994)
  - U.S. PC market share 1980 – 1998 (Narayandas & Rangan, 1996; Rivken, Porter, & Nabavi, 1999)
  - U.S. PC market share 1975 – 1981 (Reimer, 2005)
  - U.S PC market share 1994 – 2008 (Rivken, 2010)
  - U.S. PC market share 2009 – 2015 (International Data Corporation, 2016)
  - U.S. PC market share 2013 – 2010 (Gartner Group, 2020a)
  - Worldwide PC market share 2013 – 2020 (Gartner Group, 2020b)

- Cross-validated, filled, and smoothed
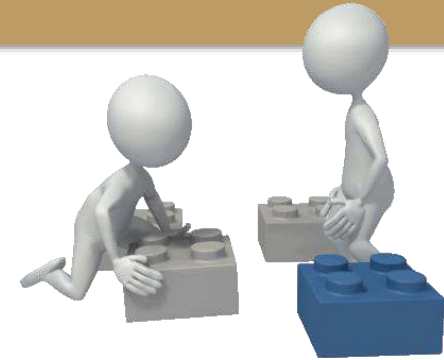
IDC
Gartner
Dataquest
ARS Technica
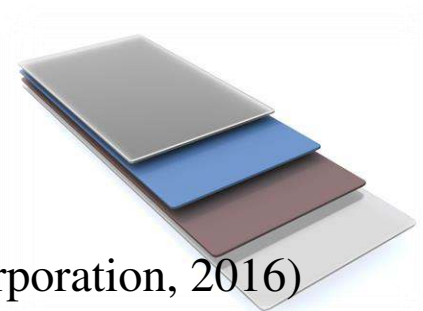
Panel 20+ experts (Ludwig, 1997; Hsu & Sandford, 2007)

Experts in the technology industry with an understanding of the evolution of the PC industry

Purposeful selection based on response to an electronic LinkedIn (social media) invitation

LinkedIn profiles reviewed for industry experience

Expert Panel Recruiting

Step 1

LinkedIn Post

↓

Experience Screen

Step 3

Expert Panel Participant → Phase 1 Survey → validate consensus → Phase 2 Survey → calculate consensus

Step 2

Experience Screen

↓

LinkedIn email

LinkedIn: 660 million members, 200 countries

50% College educated Americans

2,613 1st level connections
1.4 million 2nd level connections
Diverse industries/segments
20+ years in technology

Tran (2020)

Zhang & Vucetic (2016)

Huang, Tunkelang, & Karahalios (2014)

Unkelos-Shpigel, Sherman, & Hadar (2015)

Research Process
Participation Rates

- 30 "verified" experts

- Two rounds
  - Phase 1: Forms of innovation
  - Phase 2: Market leaders
  - Calculate consensus

- Panel target: 20 experts
  - Phase 1: 30 experts
  - Phase 2: 24 start => 19 end
  - Question fatigue vs. round fatigue

- Independent judgments

Phase 1	Participation
question 1	30
question 2	27
Phase 2	
Altair	24
AST/Tandy	23
Apple 1	23
IBM	23
Commodore	19
Apple 2	20
Packard Bell	18
Compaq	19
Dell	19
HP	19
Lenovo	19

Forms of Innovation

Marketing

Organizational

Product

Process

Consistent with 3rd Edition Oslow Manual (OECD, 2005)

PC Industry Market Share Leaders 1975 to 2019
U.S. units sold

1975-76	1977-80	1981-82	1983-90	1986; 1989; 1991	1992-93	1994-95	1996-99	2000-08	2009-19	2013-19
Altair	**AST/Tandy**	Apple	IBM	Commodore	Apple	Packard Bell (NEC)	Compaq	Dell	HP	Lenovo*

*worldwide

Market share data. Numbers are based on results reported publicly by International Data Corporation (IDC), Gartner Group, and Ars Technica.

Please rate the importance of the form of innovation in establishing market leadership for **AST/Tandy in 1977**:

	not important								very important
a₁ Product innovation (changes in product produced)	O	O	O	O	O	O	O	O	O
a₂ Process innovation (changes in production process)	O	O	O	O	O	O	O	O	O
a₃ Marketing innovation (changes in marketing mix)	O	O	O	O	O	O	O	O	O
a₄ Organizational innovation (changes in structure / operation of organization)	O	O	O	O	O	O	O	O	O

What is your confidence level in these rankings?

	not confident								very confident
Confidence level	O	O	O	O	O	O	O	O	O

While a market leader, did the focus of innovation by this company change?

Likert Scale 1..9

$$a_{ij} = |judgment_{ik} - judgment_{jk}| + 1$$

Saaty Scale 1..9 (pairwise)

pairwise

ordinal scale

$$\begin{array}{c} \\ a_1 \\ a_2 \\ a_3 \\ a_4 \end{array}
\begin{array}{cccc} a_1 & a_2 & a_3 & a_4 \\ \left[\begin{array}{cccc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array}\right] \end{array}$$

(1)

$$\begin{array}{c} \\ a_1 \\ a_2 \\ a_3 \\ a_4 \end{array}
\begin{array}{cccc} a_1 & a_2 & a_3 & a_4 \\ \left[\begin{array}{cccc} 1 & a_{12} & a_{13} & a_{14} \\ 1/a_{12} & 1 & a_{23} & a_{24} \\ 1/a_{13} & 1/a_{23} & 1 & a_{34} \\ 1/a_{14} & 1/a_{24} & 1/a_{34} & 1 \end{array}\right] \end{array}$$

(2)

a_1 to a_2, a_1 to a_3, a_1 to a_4

a_2 to a_3, a_2 to a_4

a_3 to a_4

pairwise

$$X_{ij} = \frac{a_{ij}}{\sum_{i=1..n} a_{ij}}$$

$$\left[\begin{array}{cccc} X_{11} & X_{12} & X_{13} & X_{14} \\ X_{21} & X_{22} & X_{23} & X_{24} \\ X_{31} & X_{32} & X_{33} & X_{34} \\ X_{41} & X_{42} & X_{43} & X_{44} \end{array}\right]$$

$$W_j = \frac{\sum_{j=1..n} X_{ij}}{n}$$

$$\left[\begin{array}{c} W_1 \\ W_2 \\ W_3 \\ W_4 \end{array}\right]$$

(3)

Consistency Index

(4)

Saaty (1980)
Bunruamkaew (2012)

Research Process
Sample Matrix

Apple

1981 - 1982

	Product	Process	Marketing	Organizational
Geometric Mean	8.26	4.50	6.91	3.76
Arithmatic Mean	8.35	5.22	7.39	4.65

$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
3.76	1.34	4.50	-2.42	0.74	3.16

	a_1	a_2	a_3	a_4
a_1	1.00	4.76	2.34	5.50
a_2	0.21	1.00	0.29	1.74
a_3	0.43	3.42	1.00	4.16
a_4	0.18	0.58	0.24	1.00
sum	1.82	9.75	3.88	12.40

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.55	0.49	0.60	0.44	0.52	4.07
X_2	0.12	0.10	0.08	0.14	0.11	4.04
X_3	0.23	0.35	0.26	0.34	0.29	4.06
X_4	0.10	0.06	0.06	0.08	0.07	4.05
	1.00	1.00	1.00	1.00	CI	0.02
					RI	0.90
					CR	0.02

4 forms innovation
11 market leaders
45 years

Research Process
Summary Results

Geometric Mean	Period	Product	Process	Marketing	Organizational
Altair	1975 - 1976	7.60	3.15	3.90	2.25
AST/Tandy	1977 - 1980	6.78	4.45	5.99	2.68
Apple 1	1981 - 1982	8.26	4.50	6.91	3.76
IBM	1983 - 1988, 1990	6.15	5.53	6.15	5.29
Commodore	1986, 1989, 1991	6.18	4.49	5.17	3.69
Apple 2	1992 - 1993	7.57	5.00	7.08	4.63
Packard Bell	1994 - 1995	4.62	5.56	5.14	4.21
Compaq	1996 - 1999	6.39	5.65	6.09	4.39
Dell	2000 - 2008	5.59	7.59	7.90	6.12
HP	2009 - 2020	5.21	5.02	5.55	5.50
Lenovo	2013 - 2020	5.56	5.37	6.47	4.85

Pairwise Analysis	Period	Product	Process	Marketing	Organizational	CR
Altair	1975 - 1976	0.62	0.12	0.17	0.07	0.02
AST/Tandy	1977 - 1980	0.46	0.15	0.31	0.07	0.02
Apple 1	1981 - 1982	0.52	0.11	0.29	0.07	0.02
IBM	1983 - 1988, 1990	0.32	0.20	0.32	0.17	0.00
Commodore	1986, 1989, 1991	0.45	0.17	0.26	0.11	0.01
Apple 2	1992 - 1993	0.44	0.12	0.34	0.10	0.01
Packard Bell	1994 - 1995	0.19	0.37	0.28	0.15	0.00
Compaq	1996 - 1999	0.37	0.22	0.30	0.11	0.00
Dell	2000 - 2008	0.11	0.33	0.40	0.15	0.00
HP	2009 - 2020	0.22	0.19	0.30	0.29	0.00
Lenovo	2013 - 2020	0.23	0.20	0.42	0.14	0.00

ratio scale

AIJ vs. AIP
Forman & Peniwati (1997)

Innovators 2.5%

early adopters 13.5%

early majority 34%

late majority 34%

laggards 16%

3   12   10   13

89.3%

1975   1978   1990   2000   2011   2013   2016   2025

U.S. Census Bureau (2014, 2018)

Market Leadership
Forms of Innovation vs. Lifecycle Stage

Innovators 2.5%	early adopters 13.5%	early majority 34%	late majority 34%	laggards 16%
3 years	12 years	10 years	13 years	3 years

89.3%

product (technology) trends down

marketing trends up

organizational trends up

process trends up, then falls

Product   Process   Marketing   Organizational

Market Leadership
Forms of Innovation vs. Lifecycle Stage

market segmentation
business, consumer, education…

ratio scale

peak

Confidence 5+
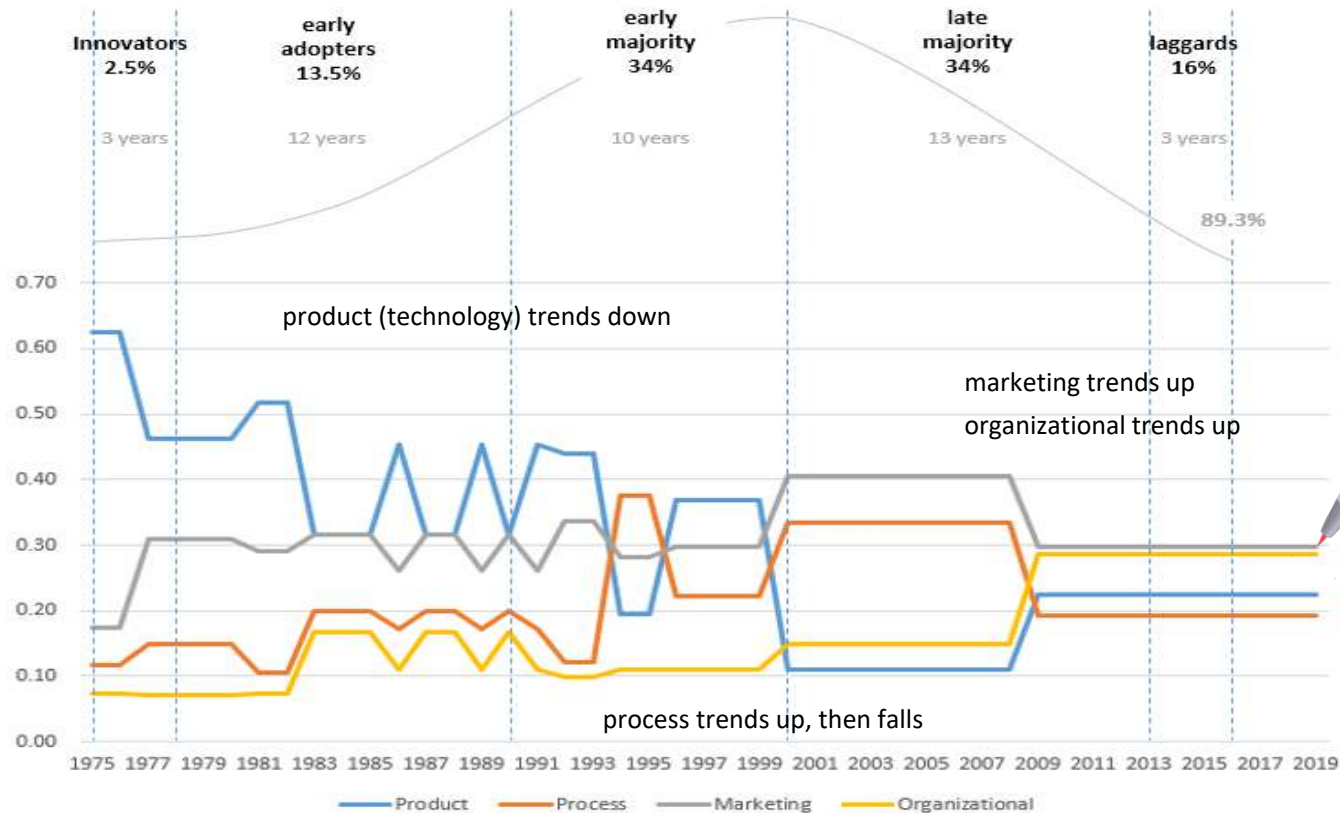
Research Process
Business Market Diffusion
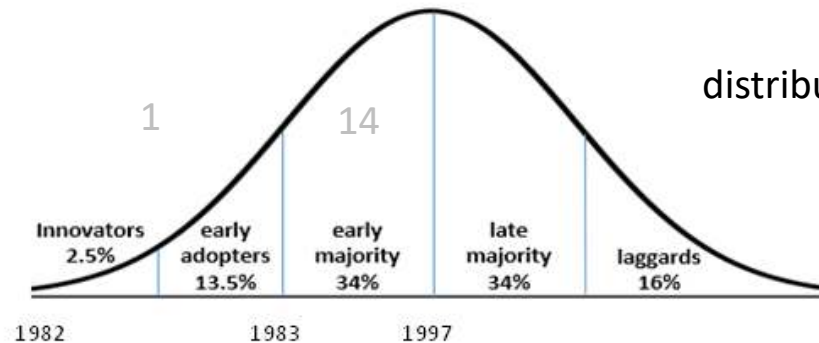
distribution is <u>not</u> normal

	Innovators 2.5%	early adopters 13.5%	early majority 34%	late majority 34%	laggards 16%
	1982	1983	1997		

1   14

mid-point difference(s)

Year	1984	1989	1993	1997	2001	2003	mid-point
Total	24.4	37.3	46.6	50.6	53.5	55.5	1997
years	2	5	4	4	4	2	
growth rate	24%	11%	6%	2%	1%	2%	

Year	1984	1989	1993	1997	2001	2003	mid-point
Professional & technical	38.1	54.4	65.7	73.1	78.9	78.7	1988
Managers & administrators	42.5	61.8	73.7	78.7	80.4	80.8	1986
Sales	23.9	35.5	49.8	55.8	57.7	59.7	1993
Clerical	47.4	66.8	77.4	78.6	73.6	73.5	1985
Craftsmen	10.1	15.2	23.5	25.3	29.9	31.9	tbd
Operatives	5.8	9.6	15.7	18.6	19.5	21.5	tbd
Laborers	3.2	6.6	11.7	12.8	13.7	15.7	tbd
Service	6.0	9.8	15.1	16.8	23.3	27.5	tbd

2025

Bureau of Labor Statistics (2005), Friedberg (2003), Hipple & Kosanovich (2003)

- Product, process, marketing, organizational innovation

- AHP decision model shows promise
  - Reduce e-Delphi rounds
  - Likert to pairwise
    - Reduce comparisons [N(N-1)/2 vs. N]
    - Eliminate inconsistency [a > b & b > c => a > c]
    - Zero value case [completely unimportant]
  - Ratio results

- Diffusion not "normal" in sub-segments

- Product -> process innovation early-mid cycle (A-U model)

- Marketing/organizational innovation mid-late stage

diminishing marginal value   diminishing marginal effectiveness

rate of innovation

product (technological) innovation

process innovation

marketing innovation

lower price vs. higher margin

organizational innovation

low

t

Expanded A-U Model
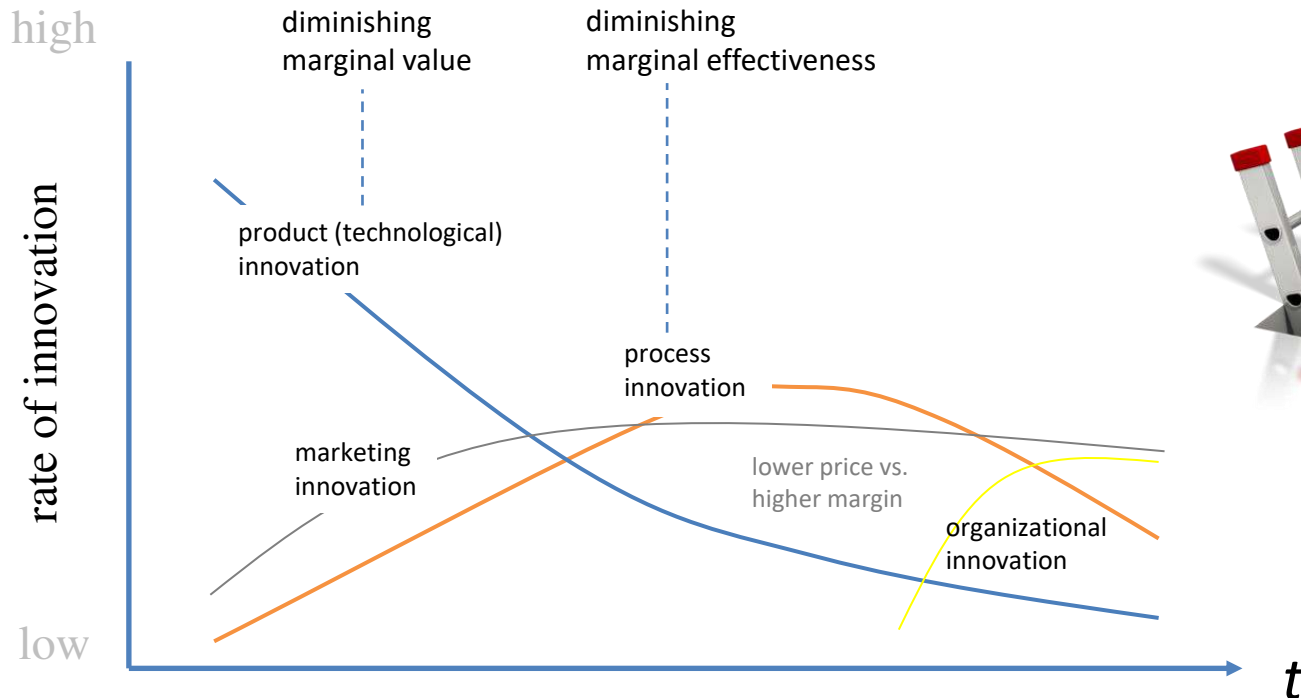
Innovation vs. market leadership

Mantovani (2006)

Christensen (1997)

Utterback (1994)

Utterback & Abernathy (1975)

Recommendations

- Utterback & Abernathy (1975) based on 567 commercial innovations, 5 industries, 120 firms. Expand research to additional products and industries to validate.

- Examine all competitors to identify what forms of innovation did not result in market leadership

- Explore Rogers (1962, 2003) model within sub-segments and specific demographic attributes in complex markets

Recommendations

- Standardize definition of business model innovation and test against organizational innovation

- Create tool to traverse social networks to measure demographic diversity and research project fit (target)

- Expand testing of Likert-pairwise technique

Questions

IEMS Conference
March 16, 2021

More to come...

Thank you

IEMS Conference
March 16, 2021

References

Akiike, A. (2013). Where is Abernathy and Utterback model? *Annals of Business Administrative Science,* 12(5), 225-236. doi:10.7880/abas.12.225

Atkinson, R. (2011). U.S. competitiveness facts. *U.S. Competitiveness: A New Conversation with New Opportunities, March 2011.* Washington, DC: Information Technology and Innovation Foundation. Retrieved from http://www.itif.org

Bunruamkaew, K. (2012). How to do AHP analysis in Excel. *University of Tsukuba, Graduate School of Life and Environmental Sciences, Division of Spatial Information Science*.

Bureau of Labor Statistics. (2005). *Computer and internet use at work in 2003.* Washington, D.C.: U.S. Department of Labor. Retrieved from http://www.bls.gov/cps/

Christensen, C. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Boston, MA: Harvard Business School Press.

Desjardins, J. (2019). *How Tech Giants Make Their Billions* [Infographic]. Visual Capitalist. Retrieved from https://www.visualcapitalist.com/how-tech-giants-make-billions/

Donohoe, H. M., Stellefson, M., & Tennant, B. (2012). Advantages and limitations of the e-Delphi technique. *American Journal of Health Education,* 43, 38-46. doi:10.1080/19325037.2012.10599216.

Fagerberg, J. (2018). Innovation: A guide to the literature. *Innovation, Economic Development and Policy* (3-28). doi:10.4337/9781788110266.00007

Forman, E., & Peniwati, K. (1997). Aggregating individual judgments and priorities with the analytic hierarchy process. European Journal of Operational Research, 108(1), 165–169. doi:10.1016/s0377-2217(97)00244-0

Friedberg, L. (2003). The Impact of Technological Change on Older Workers: Evidence from Data on Computer Use. *ILR Review*, *56*(3), 511–529. doi:10.1177/001979390305600309

Gartner Group. (2020a). Personal computer (PCs) unit shipments in the United States by vendor from 1Q'13 to 4Q'19 (in millions) [Spreadsheet]. In *Statista*. Retrieved February 01, 2020, from https://www-statista-com.access.library.eou.edu/statistics/816356/unit-shipments-pcs-united-states-vendor/

References

Gartner Group. (2020b). Personal computer (PC) unit shipments worldwide from 2006 to 2019, by vendor (in millions) [Spreadsheet]. In *Statista*. Retrieved February 01, 2020, from https://www-statista-com.access.library.eou.edu/statistics/267023/global-pc-shipments-since-2006-by-vendor/

Hipple, S., & Kosanovich, K. (2003). Computer and Internet use at work in 2001. *Monthly Labor Review*, *126*(26). Washington, D.C.: U.S. Department of Labor. Retrieved from https://www.bls.gov/opub/mlr/

Hsu, C., & Sandford, B. (2007). The Delphi technique: Making sense of consensus. *Practical Assessment, Research & Evaluation,* 12(10), 173-192. doi:10.4018/978-1-4666-0074-4.ch011

Huang, W., Tunkelang, D., & Karahalios, K. (2014). The role of network distance in LinkedIn people search. Proceedings of the 37th International ACM SIGIR Conference on Research & Development in Information Retrieval - SIGIR '14. doi:10.1145/2600428.2609461

International Data Corporation. (2016). Personal computer (PC) shipments in the U.S. from 2009 to 2015, by vendor (in million units) [Spreadsheet]. In *Statista*. Retrieved February 08, 2020, from https://www-statista-com.access.library.eou.edu/statistics/273682/us-pc-shipments-since-2009-by-vendor/

Kallas, Z. (2011). Butchers' preferences for rabbit meat; AHP pairwise comparisons versus a Likert scale valuation. In *Proceedings of the International Symposium on the Analytic Hierarchy Process for Multicriteria Decision Making* (pp. 1-6).

Kannan, V. (2020). Canalys: Demand surges but PC shipments fall 8% due to supply chain hit by COVID-19. Portland, OR: Canalys. Retrieved from https://www.canalys.com/newsroom/global-pc-market-Q12020-COVID19

Lindgart, Z., Reeves, M., Stalk, G., & Deimler, M. (2009). *Business model innovation – When the game gets tough, change the game.* Boston, MA: Boston Consulting Group. doi:10.1002/9781119204084.ch40

Linstone, H. A., & Turoff, M. (1975). *The Delphi method: techniques and applications*. Reading, MA: Addison-Wesley Publishing Company.

Ludwig, B. (1997). Predicting the future: Have you considered using the Delphi methodology? *Journal of Extension,* 35 (5), 1-4. Retrieved from http://www.joe.org/joe/1997october/

IEMS Conference
March 16, 2021

References

Medrano, N., & Olarte-Pascual, C. (2016). An empirical approach to marketing innovation in small and medium retailers: An application to the Spanish sector. *Contemporary Economics,* Vol 10 (3), 205-216. doi:10.5709/ce.1897-9254.210

Moore, G. (1991). *Crossing the chasm.* New York, NY: Harper Collins Publishers.

Narayandas, D., & Rangan, K. (1996). *Dell Computer Corporation.* HBS No. 9-596-058. Boston, MA: Harvard Business School Publishing. Retrieved from https://www.hbr.org

OECD. (2005). *Oslo manual: Guidelines for collecting and interpreting innovation data, 3rd edition*. Paris, France: OECD Publishing. doi:10.1787/9789264013100-en

OECD. (2018). *Oslo manual 2018: Guidelines for collecting, reporting and using data on innovation, 4th edition*. Paris, France: OECD Publishing. doi:10.1787/9789264304604-en

Unkelos-Shpigel, N., Sherman, S., & Hadar, I. (2015). Finding the Missing Link to Industry: LinkedIn Professional Groups as Facilitators of Empirical Research. 2015 IEEE/ACM 3rd International Workshop on Conducting Empirical Studies in Industry. doi:10.1109/cesi.2015.14

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation*. Hoboken, NJ: John Wiley & Sons.

Porter, M. (1985). Competitive Advantage. New York, NY: Free Press.

Reimer, J. (2005). Total share: 30 years of personal computer market share figures [Data file]. *ARS Technica.* Retrieved from http://jeremyreimer.com/

Richter, F. (2017). *Five years past peak PC.* New York, NY: Statista. Retrieved from https://www.statista.com/chart/5241/global-pc-shipments-since-2008/

Rivken, J., Porter, M., & Nabavi, F. (1999). *Matching Dell.* HBS No. 9-799-158. Boston, MA: Harvard Business School Publishing. Retrieved from https://www.hbr.org

Rivken, J. (2010). *Revitalizing Dell.* HBS No. 9-710-442. Boston, MA: Harvard Business School Publishing. Retrieved from https://www.hbr.org

IEMS Conference
March 16, 2021

References

Rogers, E. (1962). *Diffusion of innovations (1st ed.).* New York, NY: Free Press.

Rogers, E. (2003). *Diffusion of innovations (5th ed.).* New York, NY: Free Press.

Saaty, T. (1980). *The analytic hierarchy process: Planning, priority setting, resource allocation*. New York, NY: McGraw Hill.

Schumpeter, J. (1934). *The theory of economic development: an inquiry into profits, capital, credit, interest and the business cycle.* Boston, MA: Harvard University Press.

Schumpeter, J. (1942). Creative destruction. *Capitalism, socialism and democracy*, 825, 82-85. New York, NY: Harper.

Steffens, J. (1994). *Computer industry forecasts and newgames: Strategic competition in the pc revolution.* New York, NY: Pergamon Press.

Teece, D. (1986). Profiting from technological innovation. *Research Policy*, 15(6), 285–306. doi:10.1016/0048-7333(86)90027-2

Tran, T. (2020). Top LinkedIn demographics that matter to social media marketers. Hootsuite. Retrieved from https://blog.hootsuite.com/linkedin-demographics-for-business/

U.S. Census Bureau. (2014). *Computer and internet use tables* [Data file]. Retrieved from https://www.census.gov/topics/population/computer-internet/data/tables.html

U.S. Census Bureau. (2018). Percentage of households in the United States with a computer at home from 1984 to 2016 [Graph/Spreadsheet]. In *Statista*. Retrieved February 01, 2020, from https://www-statista-com.access.library.eou.edu/statistics/214641/household-adoption-rate-of-computer-in-the-us-since-1997/

Utterback, J. M. (1994). *Mastering the dynamics of innovation.* Boston, MA: Harvard Business School Press.

Utterback, J. M., & Abernathy, W. (1975). A dynamic model of process and product innovation. *Omega, The International Journal of Management Science,* 3(6), 639–656. doi:10.1016/0305-0483(75)90068-7

Von Hippel, E. (2005). Democratizing innovation. Cambridge, MA: MIT University Press.

Zhang, S., & Vucetic, S. (2016). Sampling Bias in LinkedIn. Proceedings of the 25th International Conference Companion on World Wide Web - WWW '16 Companion. doi:10.1145/2872518.2889357

IEMS Conference
March 16, 2021

Backup
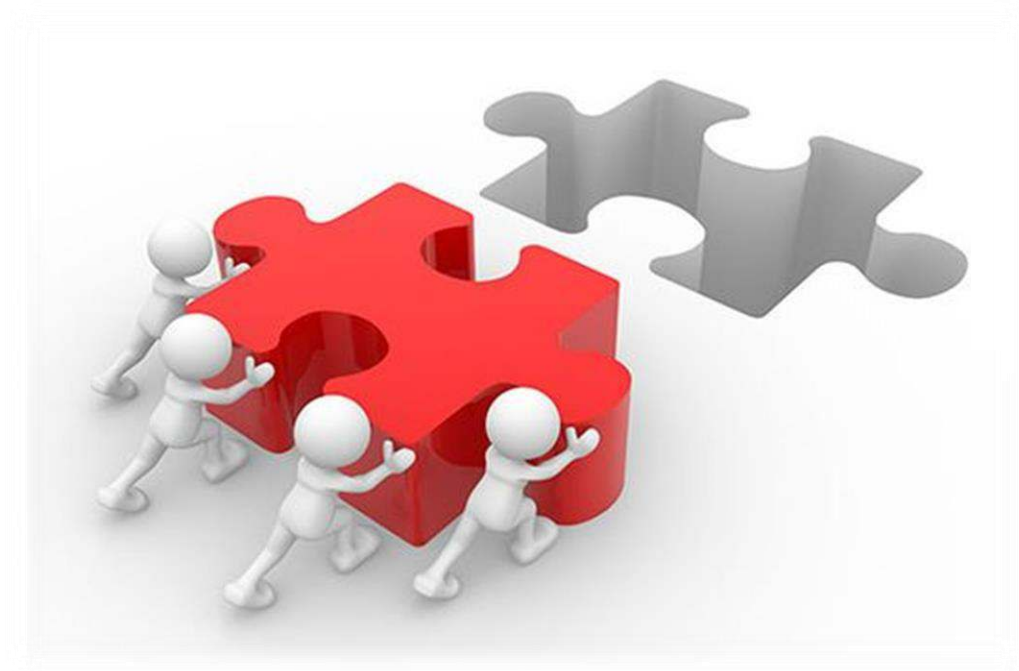
AHP Results

Altair
1975 - 1976

	Product	Process	Marketing	Organizational
Geometric Mean	7.60	3.15	3.90	2.25
Arithmatic Mean	7.83	3.79	4.88	3.17

$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
4.45	3.71	5.36	-0.74	0.90	1.65

	a_1	a_2	a_3	a_4
a_1	1.00	5.45	4.71	6.36
a_2	0.18	1.00	0.57	1.90
a_3	0.21	1.74	1.00	2.65
a_4	0.16	0.53	0.38	1.00
sum	1.55	8.72	6.66	11.90

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.64	0.63	0.71	0.53	0.62	4.08
X_2	0.12	0.11	0.09	0.16	0.12	4.03
X_3	0.14	0.20	0.15	0.22	0.17	4.05
X_4	0.10	0.06	0.06	0.08	0.07	4.07
	1.00	1.00	1.00	1.00	CI	0.02
					RI	0.90
					CR	0.02

AST/Tandy
1977 - 1980

	Product	Process	Marketing	Organizational
Geometric Mean	6.78	4.45	5.99	2.68
Arithmatic Mean	6.96	4.83	6.26	3.43

$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
2.34	0.80	4.11	-1.54	1.77	3.31

	a_1	a_2	a_3	a_4
a_1	1.00	3.34	1.80	5.11
a_2	0.30	1.00	0.39	2.77
a_3	0.56	2.54	1.00	4.31
a_4	0.20	0.36	0.23	1.00
sum	2.05	7.23	3.43	13.19

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.49	0.46	0.53	0.39	0.46	4.05
X_2	0.15	0.14	0.12	0.21	0.15	4.06
X_3	0.27	0.35	0.29	0.33	0.31	4.04
X_4	0.10	0.05	0.07	0.08	0.07	4.07
	1.00	1.00	1.00	1.00	CI	0.02
					RI	0.90
					CR	0.02

AHP Results

Apple

1981 - 1982

	Product	Process	Marketing	Organizational
Geometric Mean	8.26	4.50	6.91	3.76
Arithmatic Mean	8.35	5.22	7.39	4.65

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	3.76	1.34	4.50	-2.42	0.74	3.16

	a_1	a_2	a_3	a_4
a_1	1.00	4.76	2.34	5.50
a_2	0.21	1.00	0.29	1.74
a_3	0.43	3.42	1.00	4.16
a_4	0.18	0.58	0.24	1.00
sum	1.82	9.75	3.88	12.40

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.55	0.49	0.60	0.44	0.52	4.07
X_2	0.12	0.10	0.08	0.14	0.11	4.04
X_3	0.23	0.35	0.26	0.34	0.29	4.06
X_4	0.10	0.06	0.06	0.08	0.07	4.05
	1.00	1.00	1.00	1.00	CI	0.02
					RI	0.90
					CR	0.02

IBM

1983 - 1988, 1990

	Product	Process	Marketing	Organizational
Geometric Mean	6.15	5.53	6.15	5.29
Arithmatic Mean	6.57	6.04	6.57	5.96

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	0.62	0.00	0.87	-0.62	0.25	0.87

	a_1	a_2	a_3	a_4
a_1	1.00	1.62	1.00	1.87
a_2	0.62	1.00	0.62	1.25
a_3	1.00	1.62	1.00	1.87
a_4	0.54	0.80	0.54	1.00
sum	3.15	5.05	3.15	5.98

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.32	0.32	0.32	0.31	0.32	4.00
X_2	0.20	0.20	0.20	0.21	0.20	4.00
X_3	0.32	0.32	0.32	0.31	0.32	4.00
X_4	0.17	0.16	0.17	0.17	0.17	4.00
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

AHP Results

Commodore

1986, 1989, 1991

	Product	Process	Marketing	Organizational
Geometric Mean	6.18	4.49	5.17	3.69
Arithmatic Mean	6.47	4.89	5.68	4.37

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	1.70	1.01	2.50	-0.69	0.80	1.48

	a_1	a_2	a_3	a_4
a_1	1.00	2.70	2.01	3.50
a_2	0.37	1.00	0.59	1.80
a_3	0.50	1.69	1.00	2.48
a_4	0.29	0.56	0.40	1.00
sum	2.15	5.94	4.01	8.78

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.46	0.45	0.50	0.40	0.45	4.03
X_2	0.17	0.17	0.15	0.20	0.17	4.01
X_3	0.23	0.28	0.25	0.28	0.26	4.02
X_4	0.13	0.09	0.10	0.11	0.11	4.02
	1.00	1.00	1.00	1.00	CI	0.01
					RI	0.90
					CR	0.01

Apple

1992 - 1993

	Product	Process	Marketing	Organizational
Geometric Mean	7.57	5.00	7.08	4.63
Arithmatic Mean	7.85	5.60	7.40	5.20

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	2.57	0.49	2.94	-2.09	0.36	2.45

	a_1	a_2	a_3	a_4
a_1	1.00	3.57	1.49	3.94
a_2	0.28	1.00	0.32	1.36
a_3	0.67	3.09	1.00	3.45
a_4	0.25	0.73	0.29	1.00
sum	2.21	8.39	3.10	9.75

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.45	0.43	0.48	0.40	0.44	4.02
X_2	0.13	0.12	0.10	0.14	0.12	4.01
X_3	0.30	0.37	0.32	0.35	0.34	4.01
X_4	0.12	0.09	0.09	0.10	0.10	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.01

AHP Results

Packard Bell

1994 - 1995

	Product	Process	Marketing	Organizational
Geometric Mean	4.62	5.56	5.14	4.21
Arithmatic Mean	5.17	6.17	5.72	4.78

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	-0.94	-0.52	0.41	0.42	1.35	0.93

	a_1	a_2	a_3	a_4
a_1	1.00	0.51	0.66	1.41
a_2	1.94	1.00	1.42	2.35
a_3	1.52	0.70	1.00	1.93
a_4	0.71	0.43	0.52	1.00
sum	5.18	2.64	3.60	6.68

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.19	0.19	0.18	0.21	0.19	4.00
X_2	0.38	0.38	0.40	0.35	0.37	4.01
X_3	0.29	0.27	0.28	0.29	0.28	4.00
X_4	0.14	0.16	0.14	0.15	0.15	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

Compaq

1996 - 1999

	Product	Process	Marketing	Organizational
Geometric Mean	6.39	5.65	6.09	4.39
Arithmatic Mean	6.63	6.00	6.63	4.84

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	0.74	0.30	2.01	-0.44	1.26	1.70

	a_1	a_2	a_3	a_4
a_1	1.00	1.74	1.30	3.01
a_2	0.57	1.00	0.70	2.26
a_3	0.77	1.44	1.00	2.70
a_4	0.33	0.44	0.37	1.00
sum	2.67	4.62	3.37	8.97

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.37	0.38	0.39	0.34	0.37	4.01
X_2	0.21	0.22	0.21	0.25	0.22	4.01
X_3	0.29	0.31	0.30	0.30	0.30	4.00
X_4	0.12	0.10	0.11	0.11	0.11	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

AHP Results

Packard Bell						
1994 - 1995						
	Product	Process	Marketing	Organizational		
Geometric Mean	4.62	5.56	5.14	4.21		
Arithmatic Mean	5.17	6.17	5.72	4.78		
	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	-0.94	-0.52	0.41	0.42	1.35	0.93
	a_1	a_2	a_3	a_4		
a_1	1.00	0.51	0.66	1.41		
a_2	1.94	1.00	1.42	2.35		
a_3	1.52	0.70	1.00	1.93		
a_4	0.71	0.43	0.52	1.00		
sum	5.18	2.64	3.60	6.68		
	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.19	0.19	0.18	0.21	0.19	4.00
X_2	0.38	0.38	0.40	0.35	0.37	4.01
X_3	0.29	0.27	0.28	0.29	0.28	4.00
X_4	0.14	0.16	0.14	0.15	0.15	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

Compaq						
1996 - 1999						
	Product	Process	Marketing	Organizational		
Geometric Mean	6.39	5.65	6.09	4.39		
Arithmatic Mean	6.63	6.00	6.63	4.84		
	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	0.74	0.30	2.01	-0.44	1.26	1.70
	a_1	a_2	a_3	a_4		
a_1	1.00	1.74	1.30	3.01		
a_2	0.57	1.00	0.70	2.26		
a_3	0.77	1.44	1.00	2.70		
a_4	0.33	0.44	0.37	1.00		
sum	2.67	4.62	3.37	8.97		
	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.37	0.38	0.39	0.34	0.37	4.01
X_2	0.21	0.22	0.21	0.25	0.22	4.01
X_3	0.29	0.31	0.30	0.30	0.30	4.00
X_4	0.12	0.10	0.11	0.11	0.11	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

IEMS Conference
March 16, 2021

Dell					
2000 - 2008					
	Product	Process	Marketing	Organizational	
Geometric Mean	5.59	7.59	7.90	6.12	
Arithmatic Mean	6.11	7.79	8.11	6.47	

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	-1.99	-2.31	-0.53	-0.31	1.47	1.78

	a_1	a_2	a_3	a_4
a_1	1.00	0.33	0.30	0.65
a_2	2.99	1.00	0.76	2.47
a_3	3.31	1.31	1.00	2.78
a_4	1.53	0.41	0.36	1.00
sum	8.83	3.05	2.42	6.90

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.11	0.11	0.12	0.09	0.11	4.01
X_2	0.34	0.33	0.31	0.36	0.33	4.01
X_3	0.37	0.43	0.41	0.40	0.40	4.01
X_4	0.17	0.13	0.15	0.14	0.15	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

HP					
2009 - 2019					
	Product	Process	Marketing	Organizational	
Geometric Mean	5.21	5.02	5.55	5.50	
Arithmatic Mean	5.79	5.47	6.05	6.05	

	$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
	0.19	-0.34	-0.29	-0.53	-0.48	0.05

	a_1	a_2	a_3	a_4
a_1	1.00	1.19	0.75	0.78
a_2	0.84	1.00	0.65	0.67
a_3	1.34	1.53	1.00	1.05
a_4	1.29	1.48	0.95	1.00
sum	4.47	5.21	3.35	3.50

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.22	0.23	0.22	0.22	0.22	4.00
X_2	0.19	0.19	0.19	0.19	0.19	4.00
X_3	0.30	0.29	0.30	0.30	0.30	4.00
X_4	0.29	0.28	0.28	0.29	0.29	4.00
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

AHP Results

Dell

2000 - 2008

	Product	Process	Marketing	Organizational
Geometric Mean	5.59	7.59	7.90	6.12
Arithmatic Mean	6.11	7.79	8.11	6.47

$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
-1.99	-2.31	-0.53	-0.31	1.47	1.78

	a_1	a_2	a_3	a_4
a_1	1.00	0.33	0.30	0.65
a_2	2.99	1.00	0.76	2.47
a_3	3.31	1.31	1.00	2.78
a_4	1.53	0.41	0.36	1.00
sum	8.83	3.05	2.42	6.90

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.11	0.11	0.12	0.09	0.11	4.01
X_2	0.34	0.33	0.31	0.36	0.33	4.01
X_3	0.37	0.43	0.41	0.40	0.40	4.01
X_4	0.17	0.13	0.15	0.14	0.15	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

HP

2009 - 2019

	Product	Process	Marketing	Organizational
Geometric Mean	5.21	5.02	5.55	5.50
Arithmatic Mean	5.79	5.47	6.05	6.05

$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
0.19	-0.34	-0.29	-0.53	-0.48	0.05

	a_1	a_2	a_3	a_4
a_1	1.00	1.19	0.75	0.78
a_2	0.84	1.00	0.65	0.67
a_3	1.34	1.53	1.00	1.05
a_4	1.29	1.48	0.95	1.00
sum	4.47	5.21	3.35	3.50

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.22	0.23	0.22	0.22	0.22	4.00
X_2	0.19	0.19	0.19	0.19	0.19	4.00
X_3	0.30	0.29	0.30	0.30	0.30	4.00
X_4	0.29	0.28	0.28	0.29	0.29	4.00
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

AHP Results

	Product	Process	Marketing	Organizational
	Lenovo			
Geometric Mean	5.56	5.37	6.47	4.85
Arithmatic Mean	5.95	6.05	6.79	5.26

$a_1 \to a_2$	$a_1 \to a_3$	$a_1 \to a_4$	$a_2 \to a_3$	$a_2 \to a_4$	$a_3 \to a_4$
0.19	-0.91	0.70	-1.10	0.51	1.62

	a_1	a_2	a_3	a_4		
a_1	1.00	1.19	0.52	1.70		
a_2	0.84	1.00	0.48	1.51		
a_3	1.91	2.10	1.00	2.62		
a_4	0.59	0.66	0.38	1.00		
sum	4.34	4.96	2.38	6.83		

	X_1	X_2	X_3	X_4	mean	consistency
X_1	0.23	0.24	0.22	0.25	0.23	4.00
X_2	0.19	0.20	0.20	0.22	0.20	4.00
X_3	0.44	0.42	0.42	0.38	0.42	4.01
X_4	0.14	0.13	0.16	0.15	0.14	4.01
	1.00	1.00	1.00	1.00	CI	0.00
					RI	0.90
					CR	0.00

IEMS Conference
March 16, 2021

Research Sources
Digital Resources

+ traditional print publications…

Diffusion Curves

Year	1984	1985	1986	1987	1988	1989	1993	1997	2000	2001	2002	2003	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
									25									13							
Households	8.2%	9.6%	10.9%	12.3%	13.6%	15.0%	22.9%	36.6%	51.0%	56.3%		61.8%	69.7%	74.1%	75.6%	76.8%	78.9%	83.8%	85.1%	86.8%	89.3%				
																				86.8%	88.5%	90.2%	91.9%	93.6%	95.3%
US Workers								16																	
Overall	24.4%	27.0%	29.6%	32.1%	34.7%	37.3%	46.6%	50.6%	52.5%	53.5%	54.5%	55.5%													
						8				53.5%	54.5%	55.5%	56.5%	57.5%	58.5%	59.5%	60.5%	61.5%	62.5%	63.5%	64.5%	65.5%	66.5%	67.5%	68.5%
Professional & technical	38.1%	41.4%	44.6%	47.9%	51.1%	54.4%	65.7%	73.1%	77.0%	78.9%		78.7%													
		5																							
Managers & administrators	42.5%	46.4%	50.2%	54.1%	57.9%	61.8%	73.7%	78.7%	79.8%	80.4%	80.6%	80.8%													
		4								80.4%	80.6%	80.7%	80.9%	81.0%	81.2%	81.4%	81.5%	81.7%	81.9%	82.0%	82.2%	82.4%	82.5%	82.7%	82.8%
Clerical	47.4%	51.3%	55.2%	59.0%	62.9%	66.8%	77.4%	78.6%	75.3%	73.6%		73.5%													
Craftsmen	10.1%	11.1%	12.1%	13.2%	14.2%	15.2%	23.5%	25.3%	28.4%	29.9%	30.9%	31.9%													
											30.9%	31.9%	32.9%	33.9%	34.9%	35.9%	36.9%	37.9%	38.9%	39.9%	40.9%	41.9%	42.9%	43.9%	44.9%
Laborers	3.2%	3.9%	4.6%	5.2%	5.9%	6.6%	11.7%	12.8%	13.4%	13.7%	14.7%	15.7%													
											14.7%	15.7%	16.7%	17.7%	18.7%	19.7%	20.7%	21.7%	22.7%	23.7%	24.7%	25.7%	26.7%	27.7%	28.7%

IEMS Conference
March 16, 2021

PC Market Share Data

U.S. PC Market Share 1975 - 2019

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Acer	-	-	-	-	-	-	-	-	-	-	-	-	-
Altair	100.0%	13.0%	6.1%	3.3%	-	-	-	-	-	-	-	-	-
Apple	-	-	0.4%	9.1%	21.0%	29.3%	41.0%	28.5%	20.0%	19.0%	18.0%	16.0%	14.0%
AST/Tandy	-	-	60.8%	49.6%	48.1%	37.6%	22.5%	10.1%	5.0%	4.0%	3.0%	2.5%	2.0%
Commodore	-	-	2.4%	9.9%	15.5%	15.8%	10.6%	3.6%	21.6%	32.4%	32.8%	33.2%	20.5%
Compaq	-	-	-	-	-	-	-	-	1.1%	2.5%	4.0%	5.8%	7.5%
Dell	-	-	-	-	-	-	-	-	-	0.0%	0.0%	0.3%	0.6%
Gateway	-	-	-	-	-	-	-	-	-	-	-	-	-
HP	-	-	-	-	-	0.7%	6.1%	4.6%	-	-	-	-	-
IBM/Lenovo	-	-	-	-	-	-	5.0%	22.2%	42.0%	39.5%	37.0%	32.5%	28.0%
Microsoft	-	-	-	-	-	-	-	-	-	-	-	-	-
Osborne	-	-	-	-	-	-	1.4%	8.2%	0.5%	-	-	-	-
Packard Bell (NEC)	-	-	-	-	-	-	-	-	-	-	-	-	-
Toshiba	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	0.0%	87.0%	30.4%	28.1%	15.5%	16.7%	13.4%	22.9%	9.8%	2.6%	5.2%	9.8%	27.4%

U.S. PC Market Share 1975 - 2019

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Acer	-	-	-	-	-	-	-	-	4.5%	3.8%	3.0%	2.7%	2.3%
Altair	-	-	-	-	-	-	-	-	-	-	-	-	-
Apple	12.4%	10.7%	10.9%	13.8%	13.2%	13.4%	11.5%	10.6%	6.4%	4.1%	4.6%	3.2%	3.8%
AST/Tandy	1.9%	1.7%	1.8%	2.7%	2.8%	4.0%	3.5%	2.3%	2.4%	-	-	-	-
Commodore	17.5%	18.5%	13.6%	15.9%	9.6%	2.3%	0.3%	0.2%	-	-	-	-	-
Compaq	6.0%	4.4%	4.5%	4.1%	5.7%	9.4%	11.7%	10.8%	12.9%	16.0%	16.7%	16.2%	15.7%
Dell	0.9%	0.9%	1.0%	1.6%	3.7%	4.8%	4.2%	4.9%	6.8%	9.3%	13.2%	15.9%	18.5%
Gateway	-	0.2%	1.0%	2.5%	3.6%	4.3%	5.1%	5.1%	6.1%	7.1%	8.4%	8.6%	8.7%
HP	-	-	-	-	-	-	2.4%	3.8%	5.3%	6.6%	7.8%	6.4%	11.1%
IBM/Lenovo	22.5%	16.9%	16.1%	14.1%	11.7%	13.0%	8.7%	7.9%	8.3%	8.7%	8.2%	6.4%	5.4%
Microsoft	-	-	-	-	-	-	-	-	-	-	-	-	-
Osborne	-	-	-	-	-	-	-	-	-	-	-	-	-
Packard Bell (NEC)	-	3.3%	3.9%	4.7%	5.3%	6.4%	14.3%	14.4%	11.4%	8.8%	6.2%	5.2%	4.3%
Toshiba	-	-	-	-	-	-	-	-	-	-	1.4%	1.9%	2.3%
Other	39.0%	43.4%	47.2%	40.6%	44.4%	42.4%	38.3%	40.0%	35.9%	35.7%	30.5%	33.6%	27.9%

PC Market Share Data

U.S. PC Market Share
1975 - 2019

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Acer	2.3%	1.9%	1.5%	1.1%	0.7%	1.4%	2.4%	6.0%	9.3%	12.1%	10.4%
Altair	-	-	-	-	-	-	-	-	-	-	-
Apple	3.8%	3.8%	3.7%	3.7%	3.6%	4.4%	5.2%	6.5%	7.9%	9.0%	10.5%
AST/Tandy	-										
Commodore	-	-	-	-	-	-	-	-	-	-	-
Compaq	15.7%	-	-	-	-	-	-	-	-	-	-
Dell	18.5%	23.5%	28.5%	31.7%	34.9%	35.7%	32.8%	29.1%	29.4%	25.5%	23.4%
Gateway	8.7%	7.4%	6.0%	5.6%	5.1%	6.1%	-	-	-	-	-
HP	11.1%	18.4%	17.0%	18.8%	20.6%	20.4%	22.4%	24.8%	24.7%	25.0%	24.8%
IBM/Lenovo	5.4%	5.5%	5.6%	4.9%	4.3%	3.6%	4.2%	4.4%	4.1%	-	-
Microsoft	-	-	-	-	-	-	-	-	-	-	-
Osborne	-	-	-	-	-	-	-	-	-	-	-
Packard Bell (NEC)	4.3%	3.8%	-	-	-	-	-	-	-	-	-
Toshiba	2.3%	2.8%	2.8%	2.9%	3.1%	3.3%	3.8%	4.0%	4.6%	8.1%	8.8%
Other	27.9%	33.0%	34.9%	31.4%	27.7%	25.1%	29.2%	25.2%	20.0%	20.3%	22.1%

U.S. PC Market Share
1975 - 2019

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Acer	8%	0%	0%	0%	1%	1%	2%	3%	2%
Altair	-	-	-	-	-	-	-	-	-
Apple	11%	11%	11%	12%	13%	12%	13%	13%	13%
AST/Tandy	-	-	-	-	-	-	-	-	-
Commodore	-	-	-	-	-	-	-	-	-
Compaq	-	-	-	-	-	-	-	-	-
Dell	22%	21%	22%	24%	24%	25%	26%	27%	28%
Gateway	-	-	-	-	-	-	-	-	-
HP	26%	27%	25%	27%	28%	28%	31%	31%	30%
IBM/Lenovo	7%	8%	10%	11%	12%	14%	13%	15%	15%
Microsoft	-	-	-	-	-	-	2%	4%	4%
Osborne	-	-	-	-	-	-	-	-	-
Packard Bell (NEC)	-	-	-	-	-	-	-	-	-
Toshiba	9%	7%	7%	6%	5%	0%	-	-	-
Other	17%	26%	24%	20%	18%	19%	14%	8%	8%

Recent Sales Results (Global)
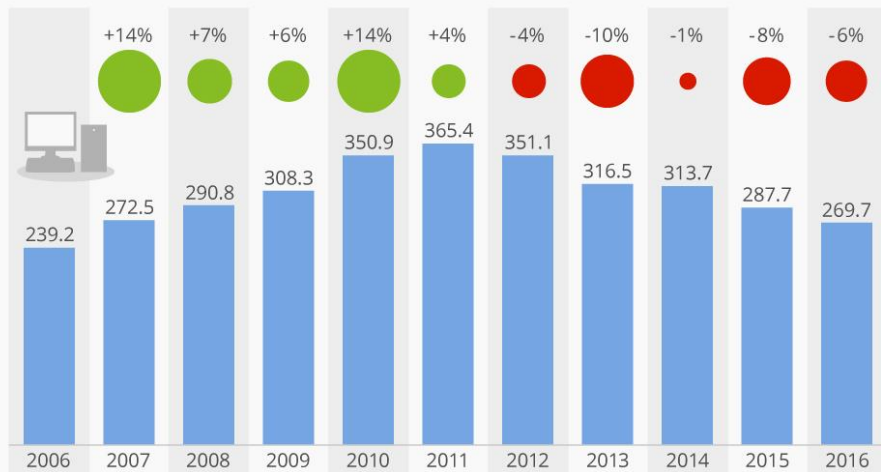
Richter (2017)

Kannan (2020)

IEMS Conference
March 16, 2021