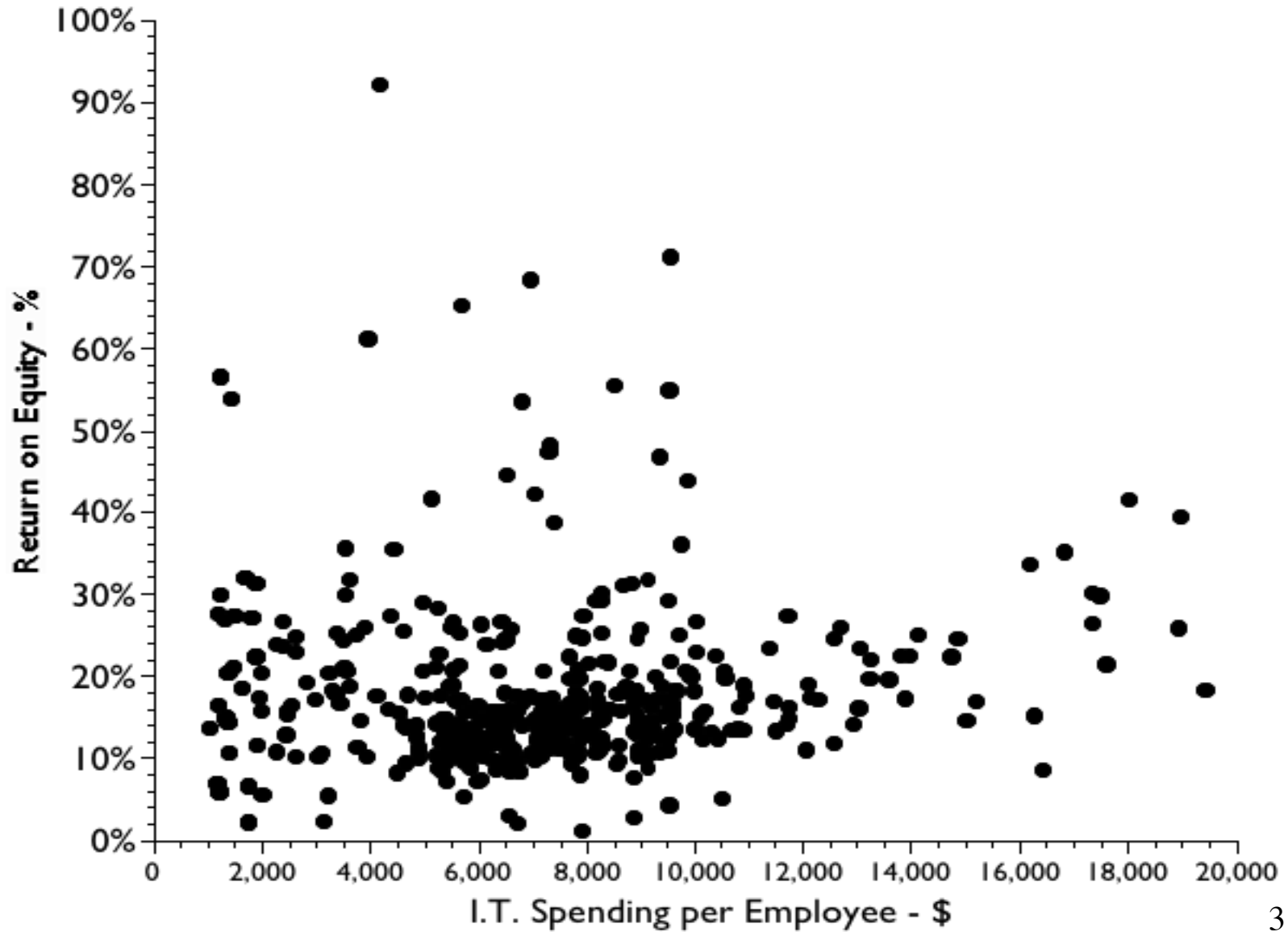


# Information Economics Metrics

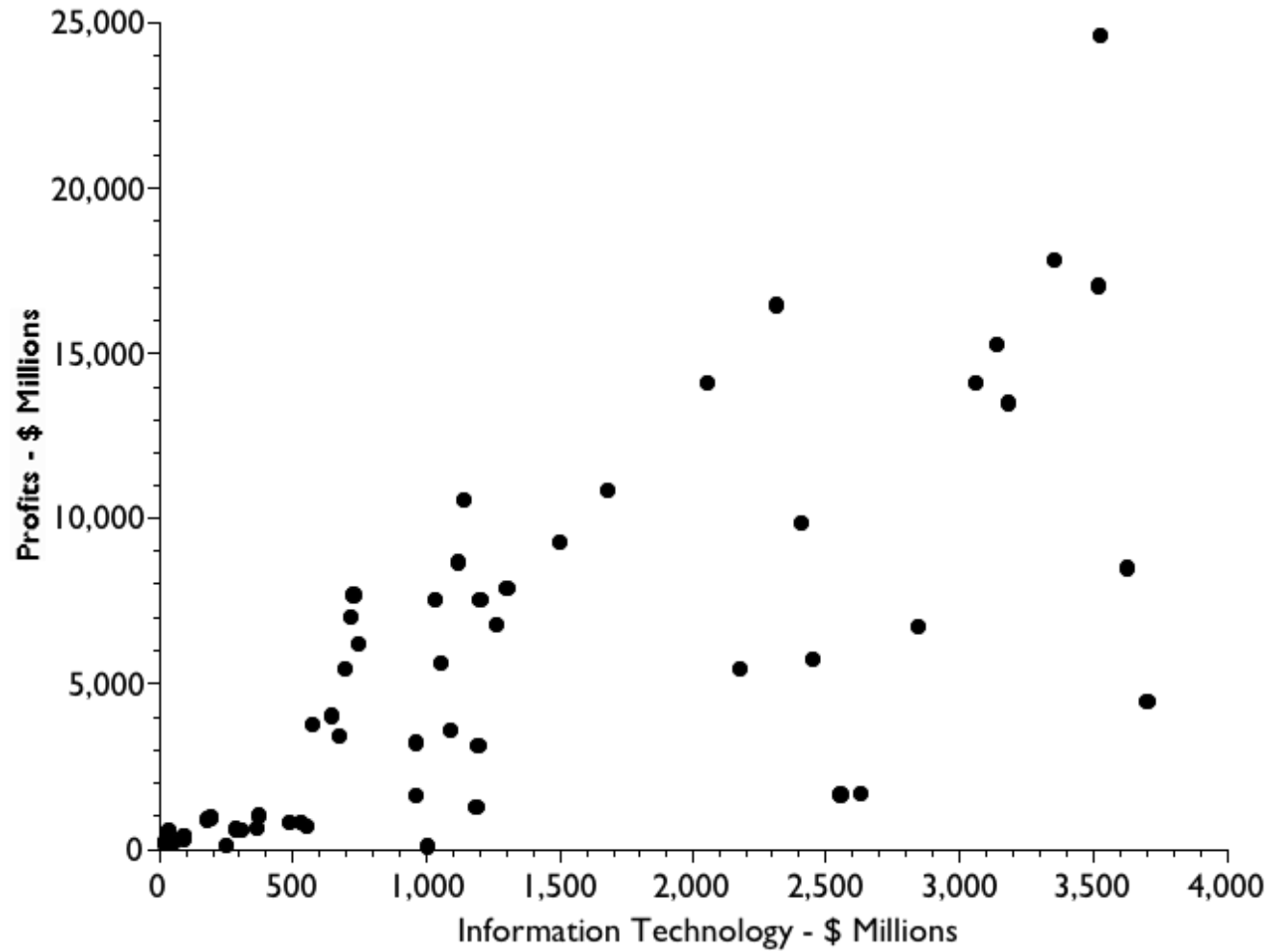
Prof. Paul A. Strassmann  
George Mason University, March 20, 2007

# *Information Technology and Profits*

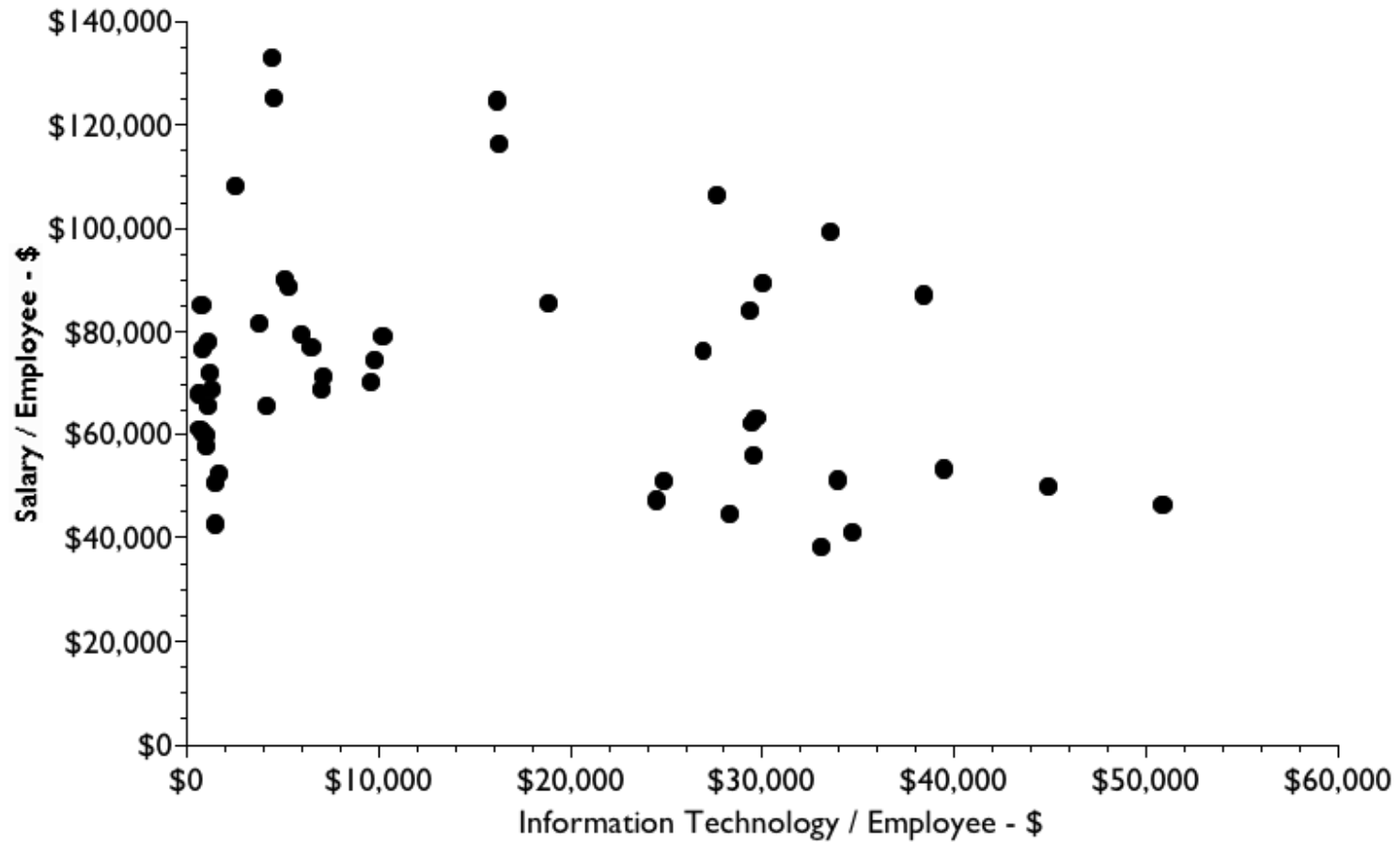
## No Correlation Between I.T. and Profitability



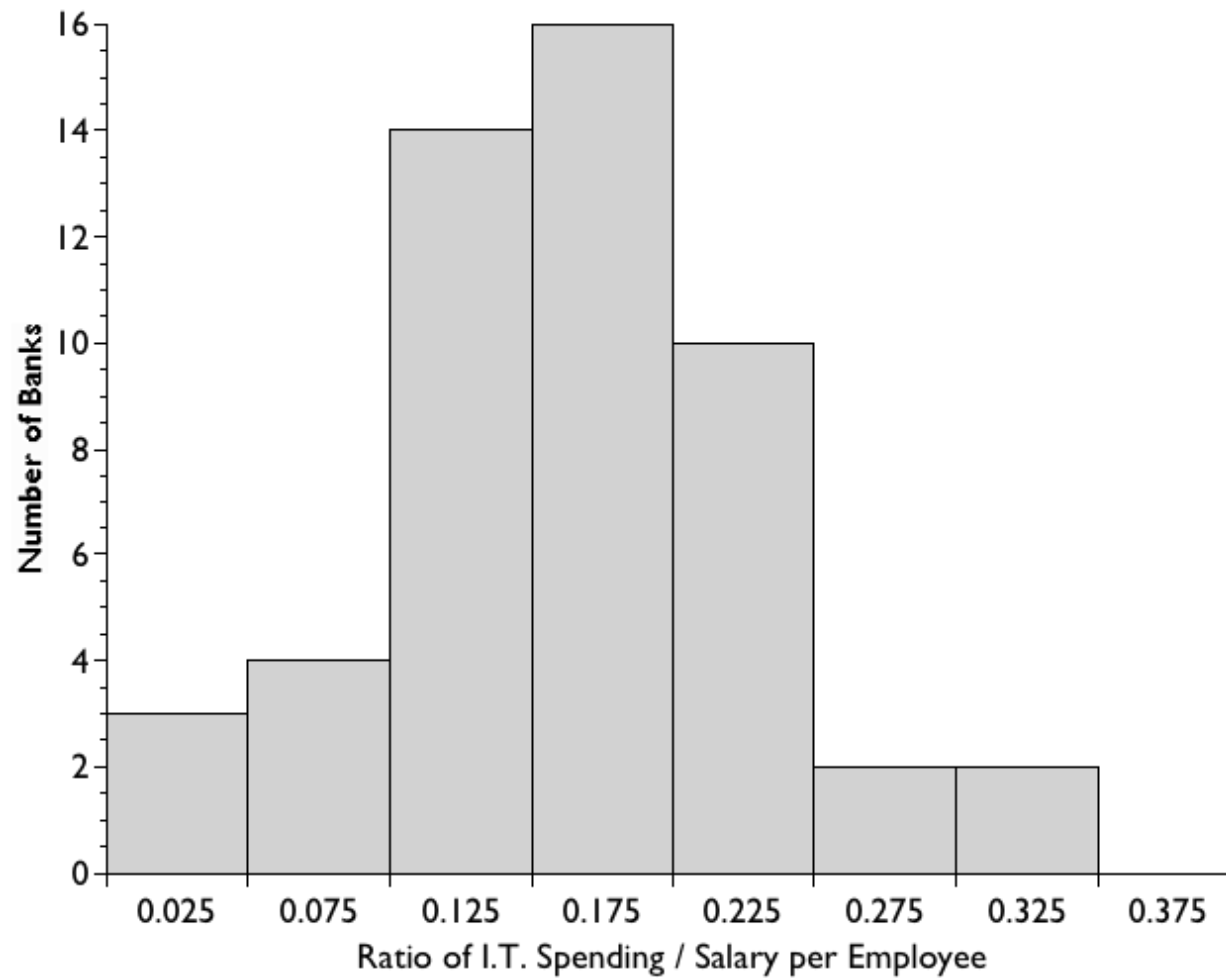
## Information Technology and Profits in Banking



## *I.T. and Salaries are Unrelated in Banking*



## *I.T. Accounts for a Large Share of Salaries in Banking*



## Comparison of I.T. Ratios and Performance for Banks

Company Name	2004 I.T. Spending - \$Millions	COST RATIO: I.T. / Compensation -%	PERFORMANCE RATIO: Information Productivity - %
WELLS FARGO	\$714	8.0%	43.0%
BANK OF AMERICA	\$2,055	15.0%	30.1%
HIBERNIA CORP	\$38	11.3%	33.0%
HUNTINGTON BANCSHARES	\$92	18.9%	36.0%
CITICORP	\$3,586	25.1%	14.0%
STATE STREET CORP	\$527	26.9%	-2.0%
JPMORGAN CHASE	\$3,702	25.5%	-95.0%

# *Information Technology Spending*



## Wide Range of I.T. Spending

Economic Sector	Cost of Goods/ Sales	Transaction Costs/ Sales	Profit/ Sales	Median Sales/ Employee	Median I.T./ Employee	Range in Estimated I.T./ Employee
Materials	76.4%	15.1%	1.3%	\$263,291	\$4,085	\$800 to \$11,774
Consumer	70.7%	18.8%	2.0%	\$104,810	\$2,401	\$404 to \$13,831
Consumer Staples	53.7%	31.7%	4.3%	\$196,167	\$6,095	\$1,252 to \$18,014
Health Care	53.7%	44.6%	1.8%	\$153,206	\$10,637	\$1,045 to \$35,138
Energy	60.2%	12.5%	5.2%	\$789,720	\$8,762	\$1,012 to \$32,173
Financials	37.6%	27.4%	14.6%	\$220,265	\$6,958	\$2,002 to \$26,108
Industrials	69.3%	19.7%	0.5%	\$162,758	\$3,814	\$1,118 to \$16,760
Information	57.7%	46.3%	-17.8%	\$139,683	\$9,475	\$1,136 to \$25,853
Telecommunication	48.6%	22.0%	-11.8%	\$290,955	\$7,450	\$322 to \$29,528

## Benchmarking I.T. Costs

I.T. Costs	\$ Millions
Proposed I.T. Budget	\$60.5
Benchmark I.T. Spending	\$57.6
Proposed - Benchmark Spending Difference	\$2.9
Proposed / Benchmark Excess	5.04%

$$\begin{aligned} \text{Benchmark I.T. Spending} = & \text{Constant} + \text{VariableA} * \text{SG\&A} + \\ & + \text{VariableB} * \text{Number of Personal Computers} + \\ & + \text{VariableC} * \text{Number of Professional Employees} + \\ & + \text{VariableD} * \text{Number of Office Clerical Employees} + \\ & - \text{VariableE} * \text{Number of Executive and Managerial Employees} + \\ & + \text{VariableF} * \text{Profit after Taxes} \end{aligned}$$

## Calculating Over- and Under-Spending on I.T.

Calculation	Action	Example
A	What is the banks's annual revenues in \$ Millions?	\$44,363,000
B	What is the bank's annual total payroll costs, in \$ Millions?	\$11,695,000
C	What is the bank's total employee count?	93,450
$D = A/C * 1000000$	Revenues per employee - \$	\$474,724,452
$E = B/C * 1000000$	Payroll cost per employee - \$	\$125,147,138
Calculations Based on Comparable Banks		
F	Constant in linear equation	\$(327.80)
G	Revenue multiplication coefficient	0.0000321823
H	Payroll multiplication coefficient	0.0000862242
$K = (F + A * G + B * H) * 1000$	Estimated I.T. Spending in \$ Millions	\$2,108,295
L	Actual I.T. Spending in \$ Millions	\$2,840,000
$M = (L - K) / K$	Overspending/ (Underspending) %	34.7%
Calculations Based on Comparable Salaries Only		
N	Constant in linear equation	\$(11,300.30)
O	Payroll cost per employee coefficient	0.000130541
P	Revenue per employee coefficient	0.0000480588
$R = (N + O * E + P * D) * 1000$	Estimated I.T. Spending per employee	\$27,851
S	Actual I.T. Spending per employee	\$30,391
$T = (S - R) / R$	Overspending/ (Underspending) %	9.1%

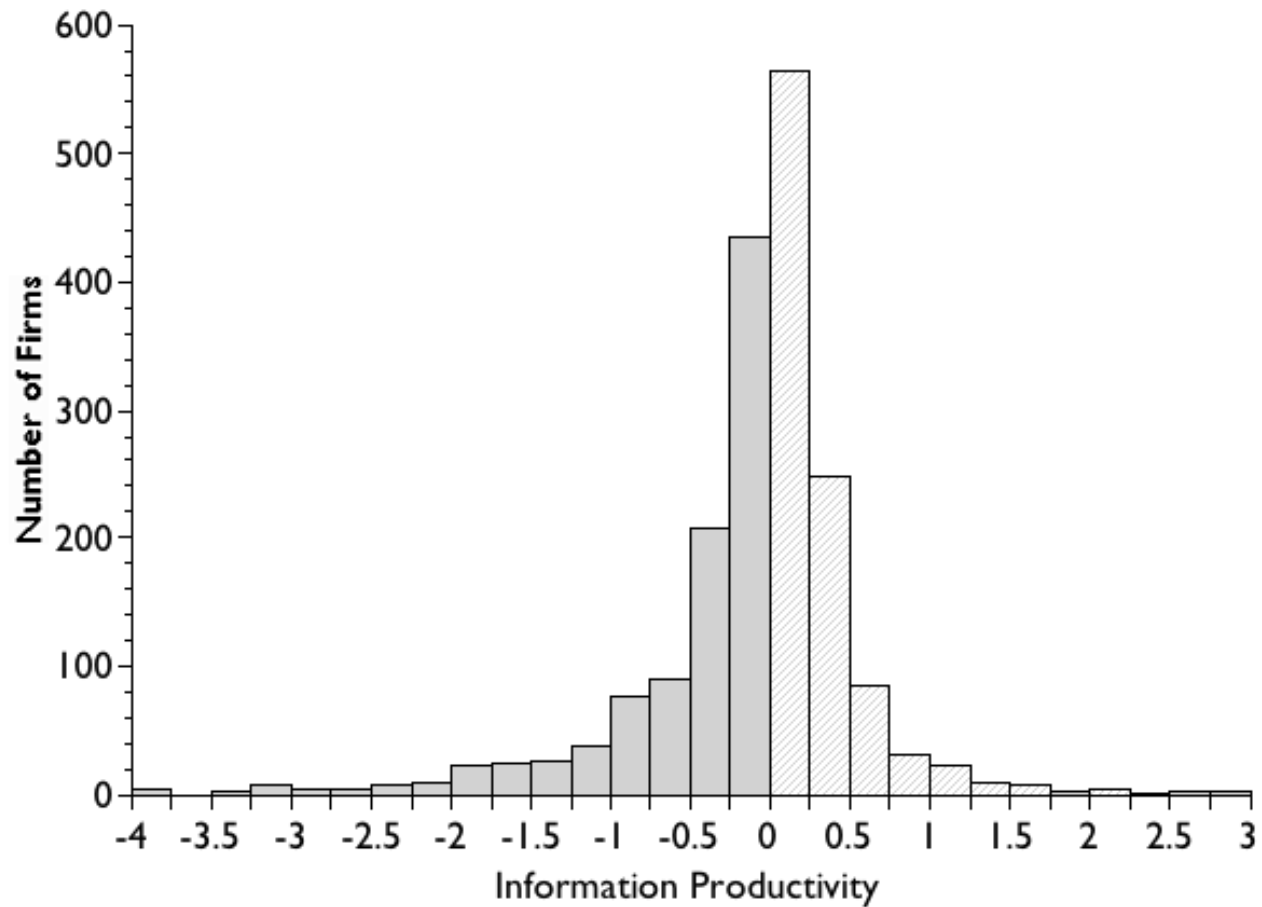
# *Information Productivity*®

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## Transaction Costs and Profits are Unrelated

Company Name	Profit/ Sales	Cost of Goods - \$Millions	Transaction Costs - \$Millions	Transaction Costs/ Cost of Goods
ROYAL DUTCH/SHELL	5.2%	\$142,760	\$13,018	9%
DEUTSCHE BANK	0.7%	\$32,174	\$13,504	42%
VOLKSWAGEN	2.7%	\$72,193	\$13,873	19%
FRANCE TELECOM	-44.5%	\$19,667	\$13,948	71%
CITICORP	16.3%	\$25,074	\$14,145	56%
JOHNSON & GLAXOSMITHKLINE	18.2%	\$8,785	\$16,173	184%
UNILEVER	18.5%	\$5,484	\$16,874	308%
SIEMENS	4.4%	\$23,794	\$17,908	75%
GENERAL MOTORS	3.1%	\$56,372	\$19,935	35%
DAIMLERCHRYSLER	0.9%	\$140,406	\$23,624	17%
NESTLE	3.3%	\$112,880	\$25,504	23%
	8.5%	\$25,873	\$28,699	111%

## Distribution of Information Productivity is Symmetric



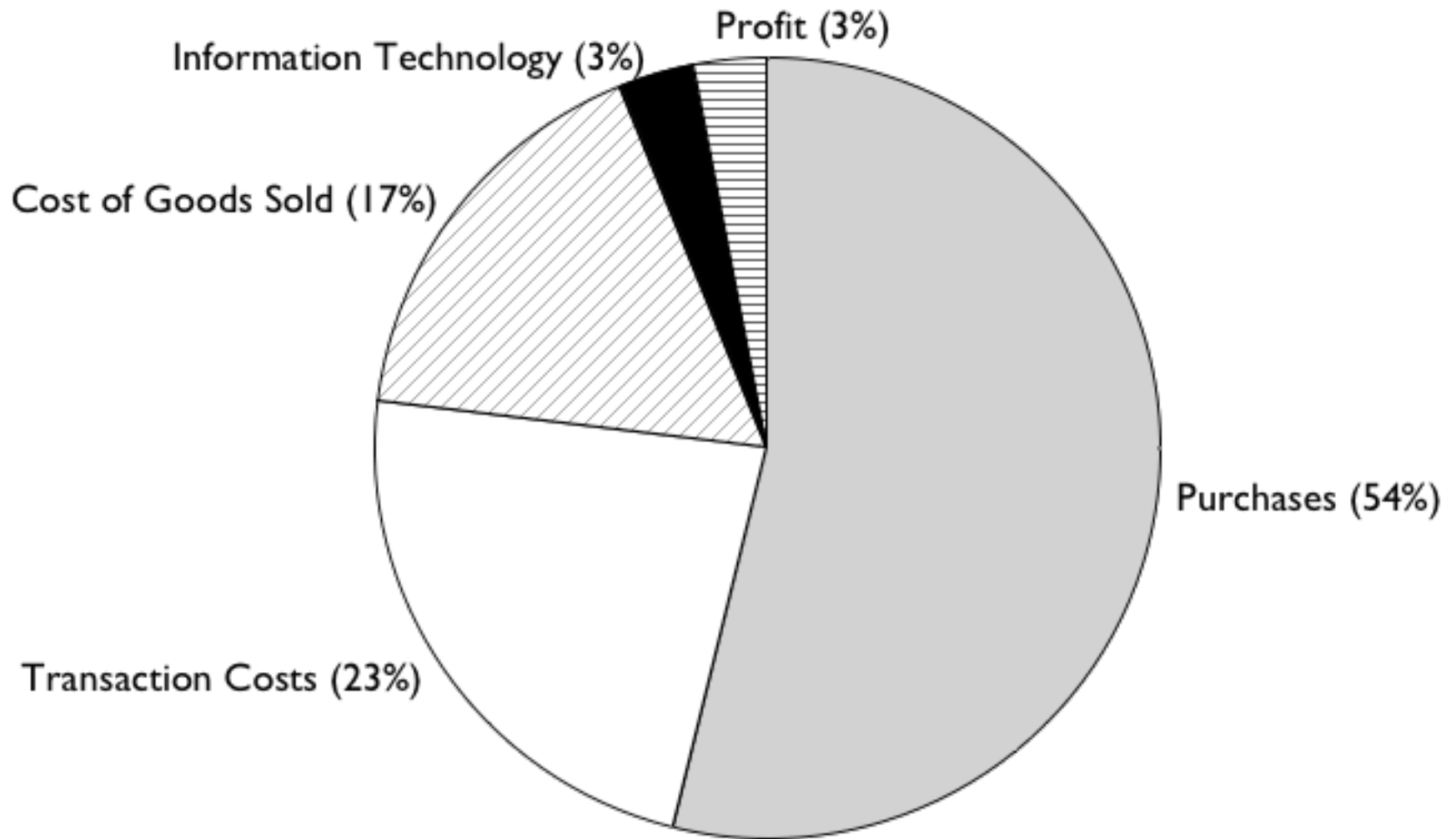
## Calculation of Information Productivity

Calculate Information Value-Added (IVA)		EXAMPLE
A	PROFIT. Net income before adjustments.	\$515,000,000
B	EXPECTED RATE OF RETURN ON CAPITAL (Capital Asset Pricing Model)	7.20%
C	SHAREHOLDER EQUITY. Total Assets minus Total Liabilities	\$3,160,000,000
$D = B * C$	RETURN a company should be earning on its invested net capital assets.	\$227,583,200
E	INFORMATION MANAGEMENT VALUE-ADDED, or IVA	\$287,416,800
Calculate Information Productivity		
F	TRANSACTION COSTS. Financial, production, sales and other transactions; Sales, General & Administrative Expense	\$37,000,000
$G = E / F$	INFORMATION PRODUCTIVITY. Divide the IVA calculated above by your company's transaction costs.	776.80%

# *Outsourcing*



## Distribution of Corporate Costs



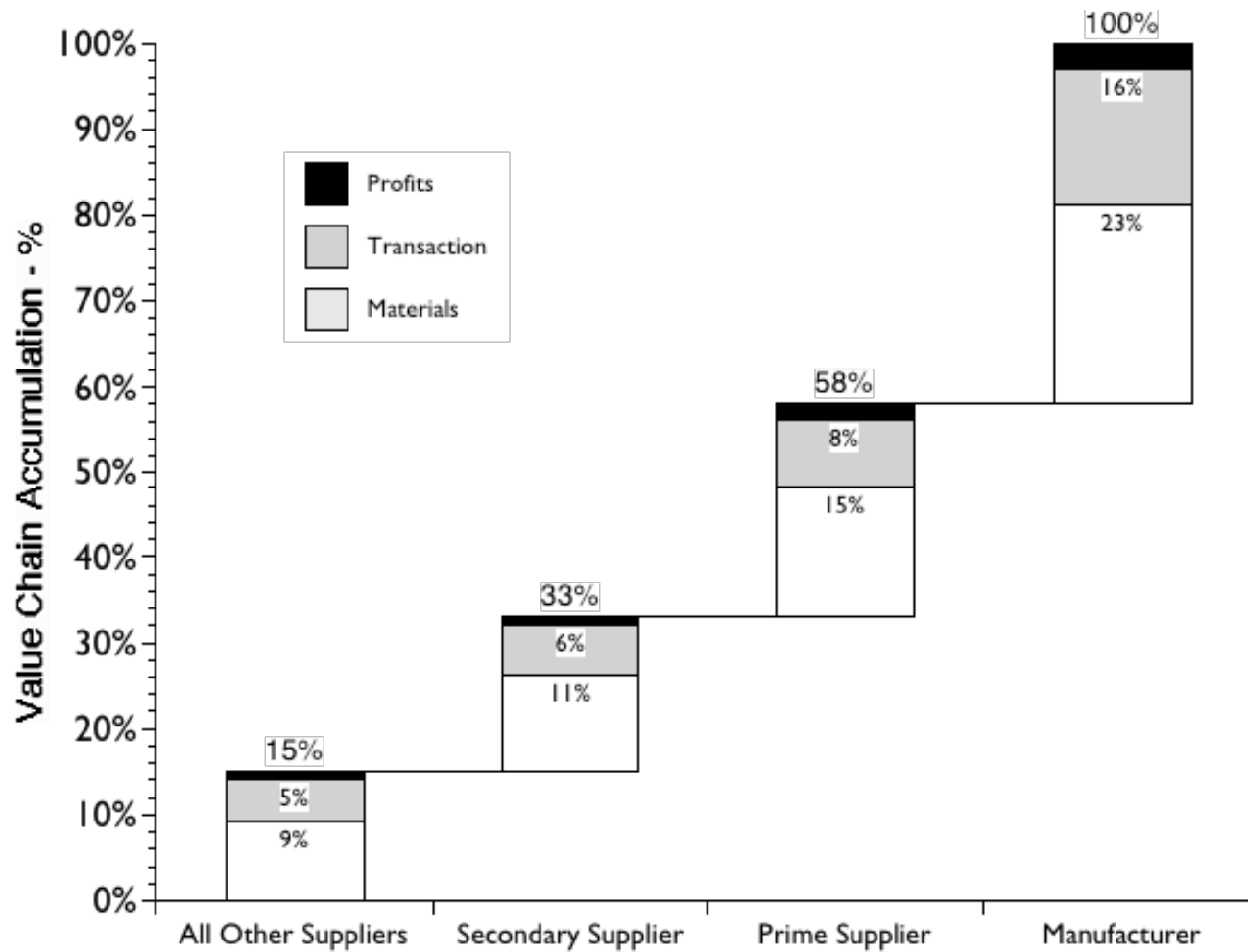
## *Purchases Is a Significant Cost Component*

Company Name - in \$Millions	Country	Revenue- Total	Value- Added	Purchases	Purchases/ Revenues
SIEMENS AG	Germany	\$93,888	\$19,978	\$73,909	79%
DAIMLERCHRYSLER AG	Germany	\$186,390	\$32,250	\$154,139	83%
SGF-SOC GENERAL	France	\$63,203	\$38,657	\$24,547	39%
ABN-AMRO	Netherlands	\$56,916	\$44,196	\$12,721	22%
WACHOVIA CORP	USA	\$35,908	\$30,590	\$5,318	15%
WELLS FARGO & CO	USA	\$40,407	\$33,622	\$6,785	17%
ROYAL BANK OF	UK	\$70,001	\$49,324	\$20,677	30%
CREDIT SUISSE GROUP	Switzerland	\$71,158	\$41,381	\$29,777	42%
MORGAN STANLEY	USA	\$51,770	\$43,603	\$8,167	16%
BARCLAYS PLC	UK	\$50,765	\$37,807	\$12,958	26%
GOLDMAN SACHS	USA	\$43,391	\$38,739	\$4,652	11%
JOHNSON & JOHNSON	USA	\$50,514	\$28,188	\$22,326	44%

## Higher Compensation Does Not Call for More Outsourcing

Company	Average Compensation per Employee	Outsourcing Ratio - %	Return on Assets - %
Johnson & Johnson	\$90,461	45.2%	14.9%
Wyeth	\$57,336	59.2%	6.6%

## Cascading of Outsourcing Through the Value-Chain



## Significance of International Outsourcing

Economic Indicator (in \$Billions)	2003	2004
U.S. GDP	\$10,919	\$11,679
U.S. Imports	\$1,016	\$1,152
% Imports/ GDP	9.3%	9.9%
OECD GDP	\$29,281	\$32,445
OECD Imports	\$6,906	\$8,218
% Imports/GDP	23.6%	25.3%

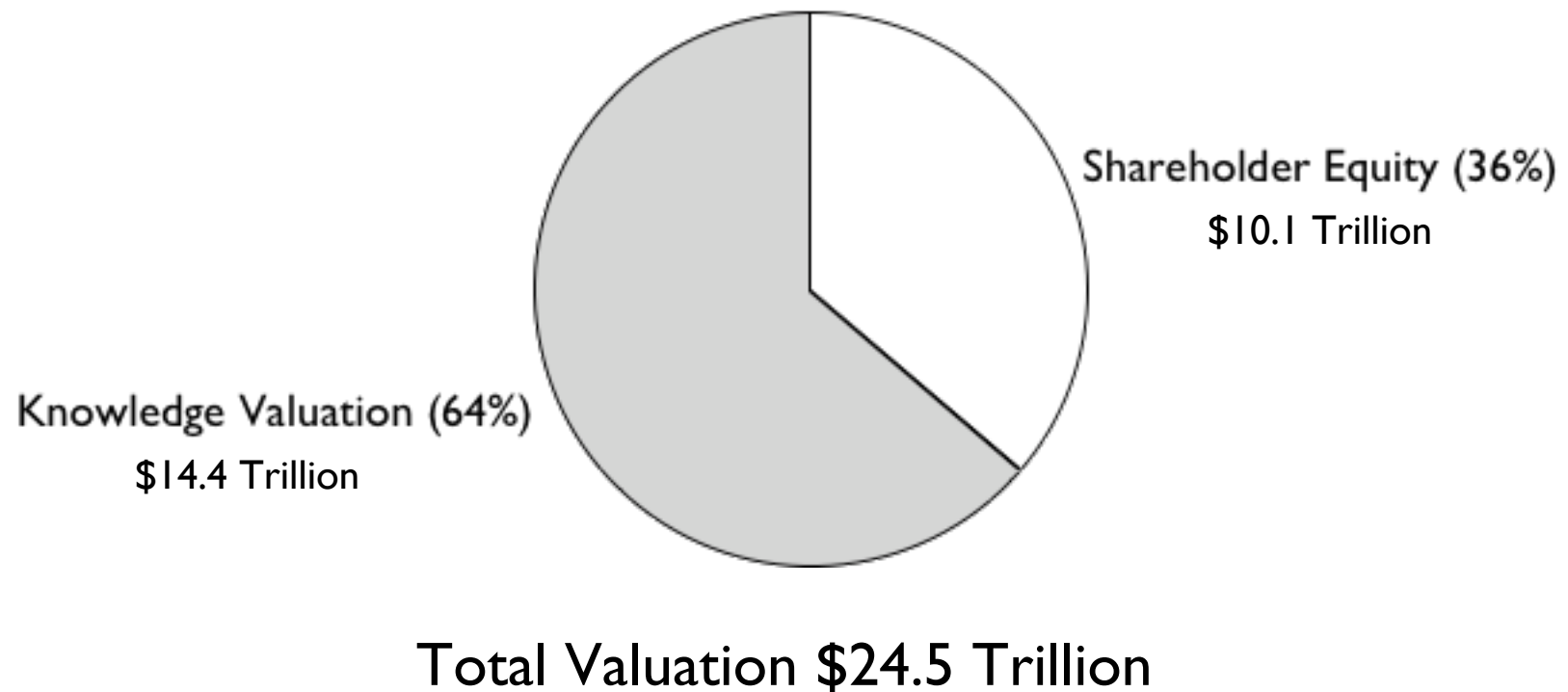
## Method for Calculating the Outsourcing Ratio

	DATA	EXAMPLE
A	Net Sales	\$41,862
B	Labor and directly related expenses	\$10,005
C	Depreciation costs	\$1,869
D	Interest costs	\$315
E	Non-operating income minus expenses	\$440
F	Special income minus losses	\$0
G	Income taxes	\$3,111
H	Income before extraordinary items	\$7,197
$I=B+C+D+E+F+G+H$	Value-added	\$22,937
$J=A-I$	Purchase of goods/services from suppliers	\$18,925
$K=J/A$	OUTSOURCING RATIO	45.2%

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## Knowledge Valuation and Shareholder Equity for 5,913 Firms (2005)





## Knowledge Value per Employee

Company Name	Market Value - \$ Millions	Financial Value- \$ Millions	Knowledge Value - \$ Millions	Knowledge Value/ Book Value	Employees - 000s	Knowledge Value / Employee - \$
JOHNSON & JOHNSON	\$188,213	\$31,813	\$156,400	492%	109.9	\$1,423,114
GLAXOSMITHKLINE	\$139,032	\$11,352	\$127,680	1125%	99.8	\$1,278,880
NOVARTIS	\$122,651	\$33,783	\$88,868	263%	81.4	\$1,091,851
WYETH	\$56,823	\$9,848	\$46,976	477%	51.4	\$913,903
ROCHE	\$81,743	\$24,731	\$57,012	231%	64.7	\$881,137
ASTRAZENECA	\$59,900	\$14,418	\$45,482	315%	64.2	\$708,440
NOVO-NORDISK	\$16,330	\$4,824	\$11,505	238%	20.3	\$567,189
SCHERING	\$14,419	\$4,074	\$10,346	254%	25.6	\$404,242

## Knowledge Value, Compensation and Net Worth of Employees

Company Name	2004 Knowledge Value/Employee	Employee Compensation in 2004	Worth of an Employee
JOHNSON & GLAXOSMITHKLIN	\$282,723	\$100,764	\$181,959
NOVARTIS	\$628,707	\$90,276	\$538,431
WYETH	\$88,463	\$85,807	\$2,656
ROCHE	\$476,222	\$63,818	\$412,403
ASTRAZENECA	\$153,463	\$109,684	\$43,779
NOVO-NORDISK	\$158,133	\$82,414	\$75,719
	\$123,923	\$83,655	\$40,268

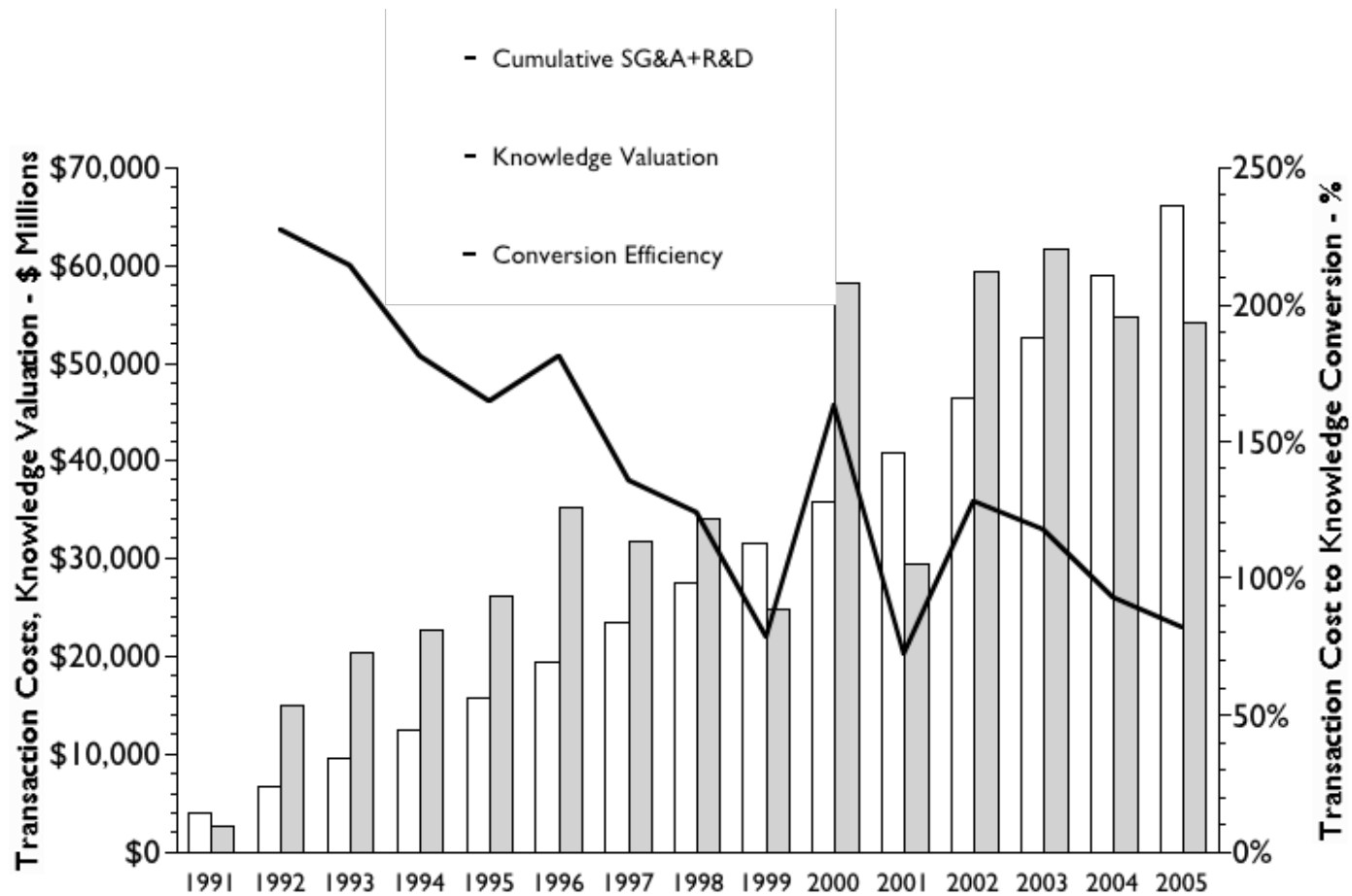
## Most of Profits Derived from Knowledge Assets

Company Name	Knowledge Value-Added - \$ Millions	Total Profit - \$ Millions	% of Profit from Financial Assets	% of Profit from Knowledge Assets
JOHNSON & JOHNSON	\$7,223	\$8,509	15.1%	84.9%
GLAXOSMITHKLINE	\$7,750	\$8,246	6.0%	94.0%
NOVARTIS	\$4,726	\$5,767	18.0%	82.0%
WYETH	\$158	\$1,234	87.2%	12.8%
ROCHE	\$3,951	\$5,819	32.1%	67.9%
ASTRAZENECA	\$2,793	\$3,813	26.8%	73.2%
NOVO-NORDISK	\$471	\$912	48.4%	51.6%
SCHERING	\$368	\$677	45.7%	54.3%

## Sector Distribution of Knowledge Capital/Employee

Sector	Employees	Knowledge Capital / Employee - \$
Materials	1,341,750	\$127,610
Consumer Discretionary	10,813,962	\$60,097
Consumer Staples	5,165,155	\$87,285
Health Care	2,531,137	\$366,398
Energy	681,928	\$455,135
Financial	3,352,421	\$328,486
Industrial	7,624,743	\$76,249
Information Technology	3,136,534	\$259,323
Telecommunications	767,444	\$187,323
Utilities	569,073	\$265,227

## Concept of Knowledge Conversion Efficiency - Abbott Laboratories



## Calculating the Worth of an Employee

	Costs and Valuations	Example
A	Market Value (Market Capitalization at Year-end) - \$ Millions	\$188,213
B	Financial Value (Shareholder Equity) - \$ Millions	\$31,813
C	Knowledge Value (At Stock-Market Prices) - \$ Millions [ A - B]	\$156,400
D	Number of Employees (in 000s)	110
E	Knowledge Value / Employee - \$ [C *1000 / D]	\$1,423,114
F	Total Employee Compensation - \$ Millions	\$11,074
G	Average Compensation / Employee - \$ [F *1000 / D]	\$100,764
H	Expected Shareholder Return on Financial Capital - per Capital	4.04%
I	Knowledge Capital Returns Multiplier [C / B]	4.92
J	Worth of Knowledge Capital - \$ Annual [E *H * I]	\$282,723
K	Average Worth of an Employee - \$ [J - G]	\$181,959

## *Social Issues*

## Employment is Shifting to Females

Occupation	Employment - 000s	Female - %	Male - %
Executive, managerial	20,450	42.5	57.5
Professional	28,795	56.3	43.7
Service occupations	23,133	57.3	42.7
Sales	16,433	49.1	50.9
Office and administrative	19,529	75.3	24.7
Natural resources, construction	15,348	4.6	95.4
Production, transportation	18,041	22.9	77.1
Total Employment	141,729	46.4	53.6



## Increased Importance of Females in Information Occupations

Managerial Occupations	Employment - 000s	Female - %	Male - %
Computer and information systems	351	32.3	67.7
Financial	1,045	51.7	48.3
Human resources	272	72.7	27.3
Medical and health	470	71.2	28.8
Social and community	307	69.3	30.7
Wholesale and retail	213	50.7	49.3
Purchasing agents	281	55	45
Human resources	660	70.9	29.1
Accountants and auditors	1,683	61.9	38.1
Insurance underwriters	110	71.9	28.1
Loan counselors and officers	439	54.1	45.9
Tax examiners, collectors	76	58.4	41.6

## Summary

- Corporate information economics offers methods for assessing the contributions of I.T. and of Transaction Costs.
- Corporate information economics offers an approach to budgeting of I.T. and in the planning for information resources.