

Q 1) To compute standard deviation of the rate of growth of total revenue across GICS sectors over 4 years

Total Revenue classified across GICS Sectors								
	Year 1	Year 2	% ROG	Year 3	% ROG	Year 4	% ROG	
1 Consumer Discretionary	\$ 1,306,636,524,000	\$ 1,359,506,280,000	4.05	\$ 1,433,673,899,000	5.46	\$ 1,523,851,904,000	6.29	
2 Consumer Staples	\$ 1,388,801,763,000	\$ 1,428,526,946,000	2.86	\$1,453,416,640,000.00	1.74	\$ 1,459,100,902,000	0.39	
3 Energy	\$ 1,352,502,544,000	\$ 1,366,043,920,000	1.00	\$1,271,860,937,000.00	-6.89	\$ 843,707,367,000	-33.66	
4 Financials	\$ 878,187,750,000	\$ 843,392,964,000	-3.96	\$ 850,512,546,000.00	0.84	\$ 843,303,463,000	-0.85	
5 Health Care	\$ 963,813,675,000	\$ 1,039,341,879,000	7.84	\$1,171,182,213,000.00	12.68	\$ 1,283,674,608,000	9.61	
6 Industrials	\$ 1,010,796,852,000	\$ 1,029,253,211,000	1.83	\$1,037,676,179,000.00	0.82	\$ 1,026,094,777,000	-1.12	
7 Information Technology	\$ 917,269,645,000	\$ 908,093,059,000	-1.00	\$ 955,502,612,000.00	5.22	\$ 881,926,904,000	-7.70	
8 Materials	\$ 285,223,746,000	\$ 291,555,004,000	2.22	\$ 295,549,075,000.00	1.37	\$ 251,951,155,000	-14.75	
9 Real Estate	\$ 55,010,248,000	\$ 61,768,962,000	12.29	\$ 69,673,022,000.00	12.80	\$ 74,766,197,000	7.31	
10 Telecommunications Services	\$ 273,043,853,000	\$ 278,472,000,000	1.99	\$ 289,106,000,000.00	3.82	\$ 310,126,000,000	7.27	
11 Utilities	\$ 252,177,719,000	\$ 264,966,001,000	5.07	\$ 278,755,544,000.00	5.20	\$ 273,125,907,000	-2.02	
Mean Rate of Growth (ROG)			3.11		3.91		-2.66	

Rate of growth of Total Revenue (% ROG) is difference between last year and current year Total Revenue converted to percentage: $((\text{Present Year Total Revenue} - \text{Last Year Total Revenue}) / \text{Last Year Total Revenue}) * 100$

Computation of Standard Deviation of mean ROG across GICS Sectors

	Year 2	Year 3	Year 4	
1 Consumer Discretionary	0.88	2.37	80.06	<p>Square of the difference between Mean Rate of Growth and ROG of particular GICS Sector. For instance 0.88 of Consumer Discretionary of Year 2 derived:</p> <p>% ROG of Year 2 = 4.05 Mean ROG across GICS Sector = 3.11 $(4.05 - 3.11)^2 = 0.88$</p>
2 Consumer Staples	0.06	4.72	9.29	
3 Energy	4.43	116.84	961.38	
4 Financials	49.97	9.43	3.28	
5 Health Care	22.37	76.92	150.37	
6 Industrials	1.64	9.59	2.38	
7 Information Technology	16.87	1.71	25.43	
8 Materials	0.79	6.48	146.27	
9 Real Estate	84.27	78.88	99.35	
10 Telecommunications Services	1.25	0.01	98.57	
11 Utilities	3.86	1.66	0.41	
Sum of the squares	186.39	308.60	1576.77	
Sum of the squares/11	16.94412101	28.05468601	143.34282	
Standard deviation	4.116323725	5.296667444	11.972586	

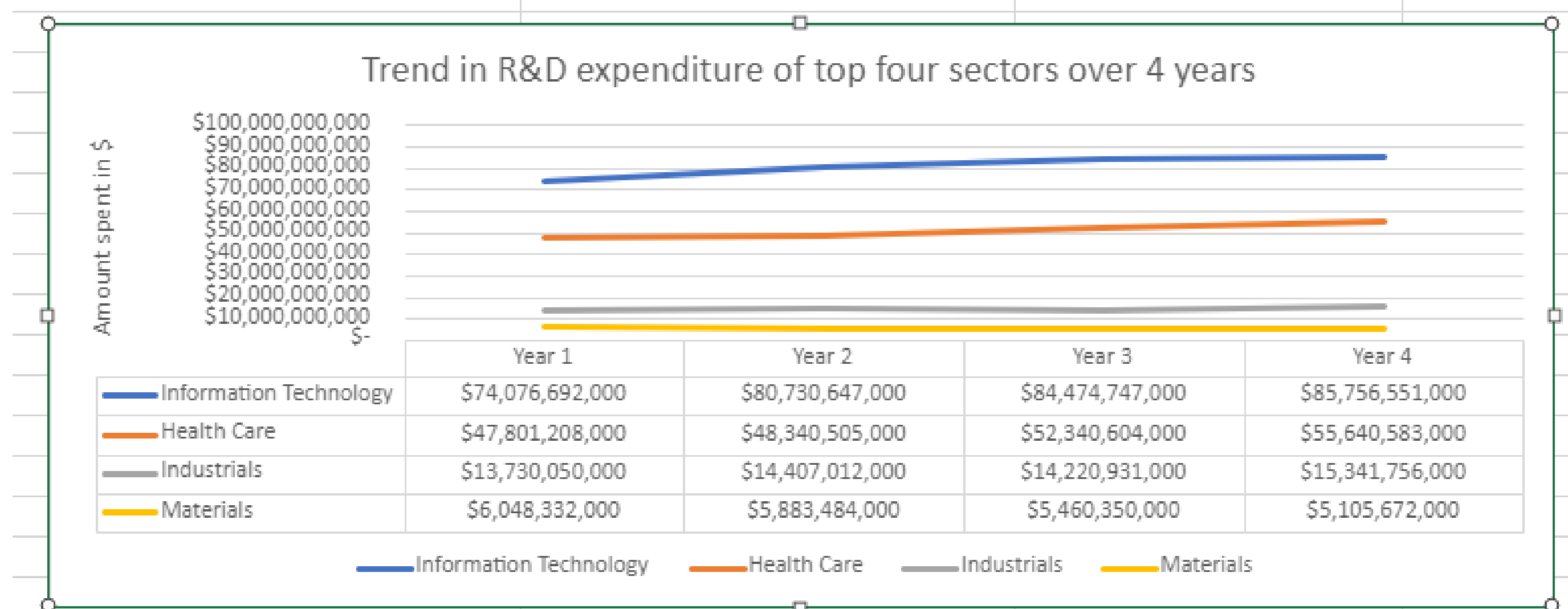
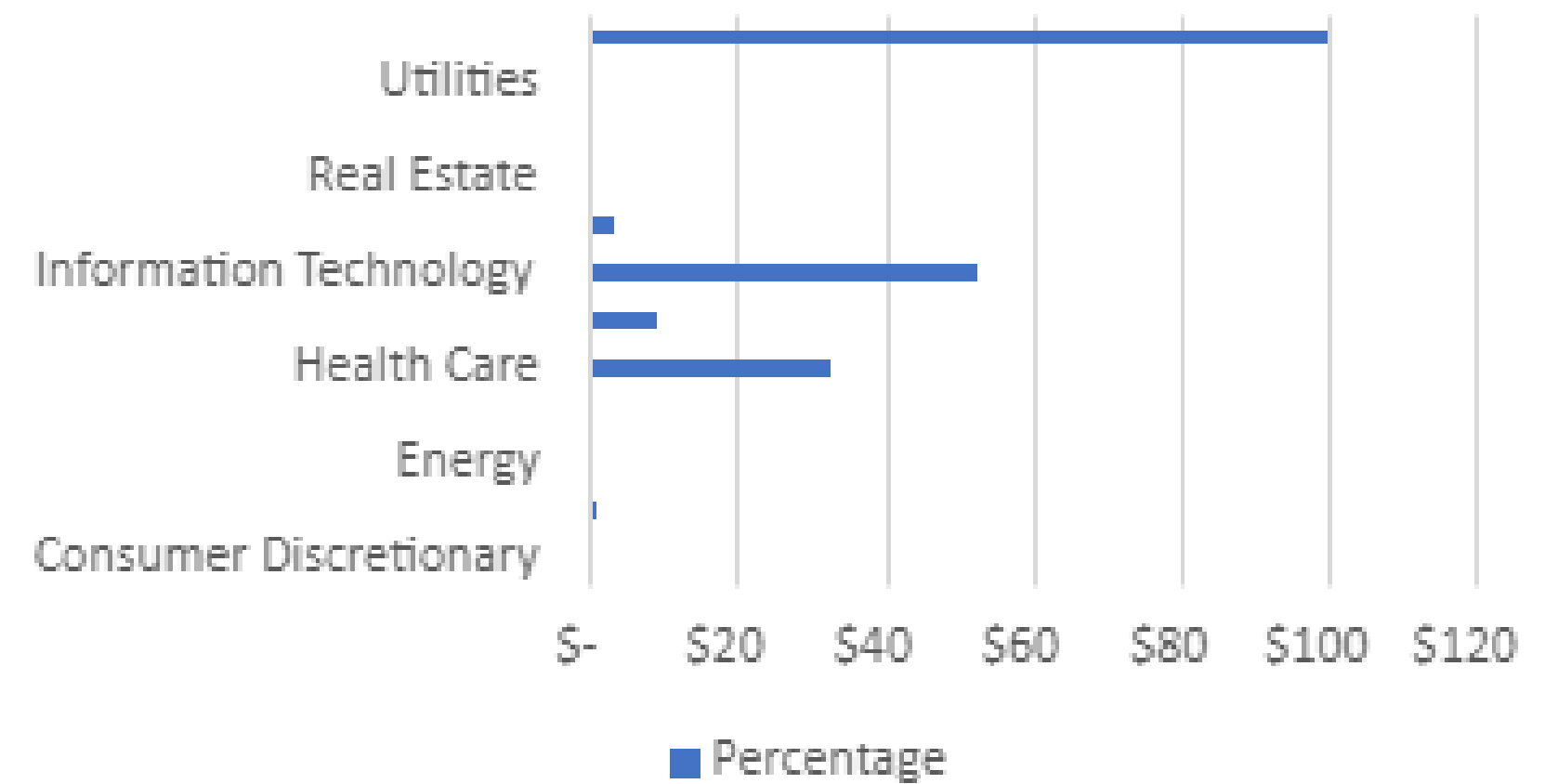
Higher standard deviation in average ROG for Year 4 of 11.97 against 5.29 of Year 3 and 4.11 of Year 1 in large part due to negative swing in Total Revenue in the energy sector -33.66% and Materials -14.75% while Health Care reporting robust 9.61% followed by Real Estate 7.31% and Telecom 7.27%.

Q2) Trend in Research & Development expenditure across GICS sectors over 4 years

SL No.	GICS Sector	Year 1	Percentage	Year 2	Percentage2	Year 3	Percentage3	Year 4	Percentage4	Total over 4 years	Percentage5
1	Consumer Discretionary	\$ 526,970,000	\$ 0	\$ 572,514,000	\$ 0	\$ 617,677,000	\$ 0	\$ 669,987,000	\$ 0	\$ 2,387,148,000	\$ 0
2	Consumer Staples	\$ 1,218,112,000	\$ 1	\$ 1,618,583,000	\$ 1	\$ 1,988,677,000	\$ 1	\$ 2,425,695,000	\$ 1	\$ 7,251,067,000	\$ 1
3	Energy	\$ 571,235,000	\$ 0	\$ 628,905,000	\$ 0	\$ 482,104,000	\$ 0	\$ 394,269,000	\$ 0	\$ 2,076,513,000	\$ 0
4	Financials	\$ 62,630,000	\$ 0	\$ 61,800,000	\$ 0	\$ 60,200,000	\$ 0	\$ 55,500,000	\$ 0	\$ 240,130,000	\$ 0
5	Health Care	\$ 47,801,208,000	\$ 33	\$ 48,340,505,000	\$ 32	\$ 52,340,604,000	\$ 33	\$ 55,640,583,000	\$ 34	\$ 204,122,900,000	\$ 33
6	Industrials	\$ 13,730,050,000	\$ 10	\$ 14,407,012,000	\$ 9	\$ 14,220,931,000	\$ 9	\$ 15,341,756,000	\$ 9	\$ 57,699,749,000	\$ 9
7	Information Technology	\$ 74,076,692,000	\$ 51	\$ 80,730,647,000	\$ 53	\$ 84,474,747,000	\$ 53	\$ 85,756,551,000	\$ 52	\$ 325,038,637,000	\$ 52
8	Materials	\$ 6,048,332,000	\$ 4	\$ 5,883,484,000	\$ 4	\$ 5,460,350,000	\$ 3	\$ 5,105,672,000	\$ 3	\$ 22,497,838,000	\$ 4
9	Real Estate	\$ 64,210,000	\$ 0	\$ 33,000,000	\$ 0	\$ 27,000,000	\$ 0	\$ 24,000,000	\$ 0	\$ 148,210,000	\$ 0
10	Telecommunications Services	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
11	Utilities	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	Total	\$144,099,439,000	\$ 100	\$ 152,276,450,000	\$ 100	\$ 159,672,290,000	\$ 100	\$ 165,414,013,000	\$ 100	\$ 621,462,192,000	\$ 100

SL No	GICS Sector	Total	Percentage
1	Consumer Discretion	\$ 2,387,148,000	\$ 0
2	Consumer Staples	\$ 7,251,067,000	\$ 1
3	Energy	\$ 2,076,513,000	\$ 0
4	Financials	\$ 240,130,000	\$ 0
5	Health Care	\$ 204,122,900,000	\$ 33
6	Industrials	\$ 57,699,749,000	\$ 9
7	Information Technolo	\$ 325,038,637,000	\$ 52
8	Materials	\$ 22,497,838,000	\$ 4
9	Real Estate	\$ 148,210,000	\$ 0
10	Telecommunications	\$ -	\$ -
11	Utilities	\$ -	\$ -
	Total	\$ 621,462,192,000	\$ 100

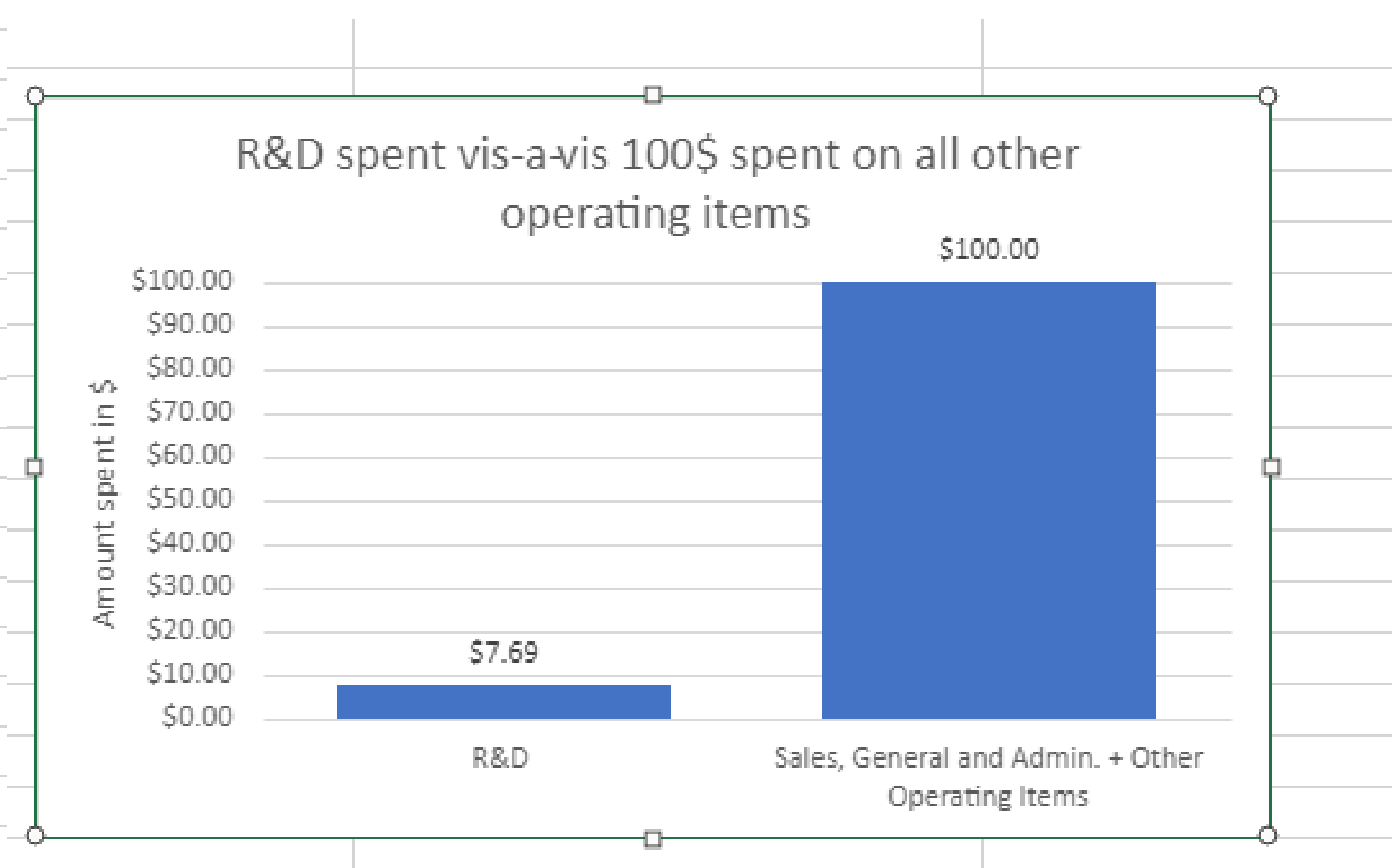
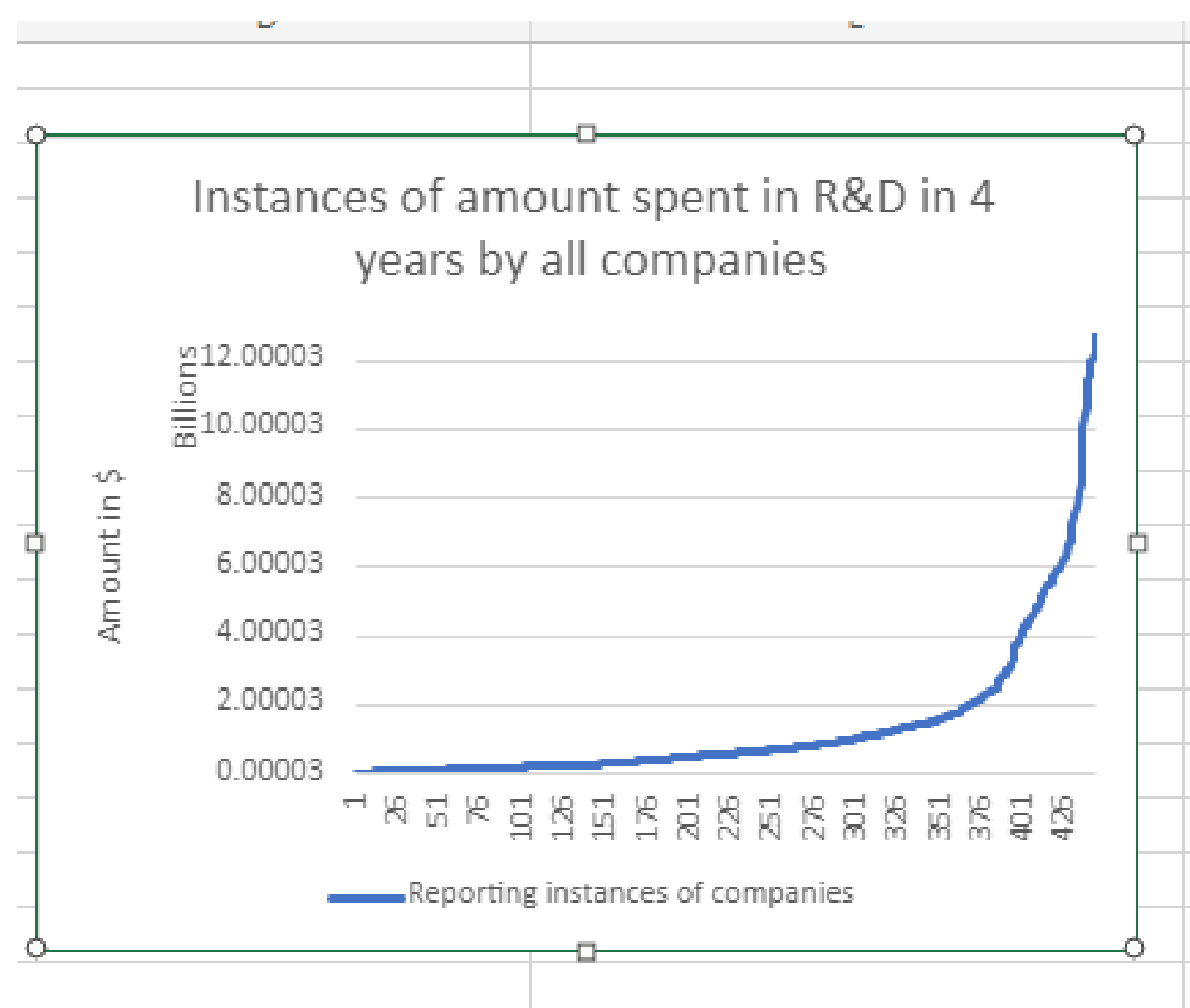
Percentage of R&D spending of each sector over total R&D spending over 4 years



Of the total R&D expenditure over 4 years across GICS sectors, Information Technology has 52% of the total followed by Health Care 33% and Industrial 9%. Consumer Discretionary, Consumer Staples, Real Estate, Energy, Financials are less than 1 percent while Materials 4 percent.

How focused are companies with research and development

1	No. of instances of yearly reporting of companies covered in the study	1710
2	No. of instances with zero spending on R&D	1249
3	No. of instances companies actually spent on R&D	461
4	Total amount spent on R&D for all instances	\$ 621,462,192,000
5	Mean spent on each instance (i.e., excluding values with 0)	\$ 1,348,074,169
6	Max	\$ 12,740,000,000
7	Min	\$30,000
8	Range	\$ 12,739,970,000
9	Mean of R&D spent for all instances (including values with 0)	\$ 363,428,182
10	Total Operating Expenses of all instances	\$8,698,076,096,000
11	Total Operating Expenses (excluding R&D) of all instances	\$8,076,613,904,000
12	Total R&D of all instances	\$621,462,192,000
13	Against 100\$ Total Operating Expenses excluding R&D, R&D spent	\$7.69



Research & Development (R&D) is an expense that might not have an immediate impact on the profitability of a company/sector but can significantly improve overall business metrics in the long run, often spanning 3 years and more. Out of 1710 reported instances, 1249 instances (73%) had zero spending on R&D. This might have inflated net operating margin, compromising long-term benefit that R&D brings into a company/sector.

Of the companies that reported R&D expenses, 30,000\$ (in consumer staples sector that otherwise had less than 1% of total share on R&D) was the minimum, 12,740,000,000\$ (of an IT company, a sector with most share of R&D commitment) the maximum, with a mean of 1,348,074,169\$.

Many experts see R&D as an investment instead of an expense. Against 100\$ spent on Sales, General, and Admin + Other Operating Items across all companies in 4 years, 7.69\$ spent on R&D.