VICTORIA UNIVERSITY OF WELLINGTON

GRADUATE SCHOOL OF BUSINESS
AND GOVERNMENT MANAGEMENT

WORKING PAPER SERIES 8/90

Why do some societies invent more than others?

Scott A. Shane *

* The Department of Management
The Wharton School of the
University of Pennsylvania
Philadelphia PA 19104-6370

The Management Group
Faculty of Commerce and Administration
Victoria University of Wellington

September 1990

ISSN 0114-7420
ISBN 0-475-11427-2

Why Do Some Societies Invent More Than Others?

Scott A. Shane
Department of Management
2000 Steinberg-Dietrich Hall
The Wharton School of the
University of Pennsylvania
Philadelphia, PA 19104-6370
(215) 898-3002

Acknowledgements: I would like to thank the Graduate School of Business and Government Management of Victoria University of Wellington, New Zealand, and the Sol C. Snider Entrepreneurial Center at The Wharton School of the University of Pennsylvania for the financial support that made this research possible. I would also like to thank Russ Knight for his comments on an earlier draft of this paper. An earlier version of this paper was presented at a Graduate School of Business and Government Management seminar in July 1990.

Abstract

This study provides a cultural explanation for why some societies invent and innovate more than others. It shows that there are significant positive spearman rank correlations between per capita number of patent applications filed by nationals of 33 countries, measured in 1967, 1971, 1976, and 1980, and Hofstede's (1980) indices of individualism and lack of power distance. It also shows that these relationships hold over time and when per capita inventiveness is adjusted for the wealth of a society.

Keywords: Innovation, invention, culture, individualism, power distance.

Why do some countries invent and innovate more than others? Economists have suggested a number of explanations. Invention and innovation result from demand (Myers and Marquis, 1969; Schmookler, 1962), public and governmental support (Schwartz and Vertinsky, 1980), imitation (Schumpeter, 1934), research intensity (Mansfield, 1968, 1971, 1981), and stages of a product's life cycle (Utterback and Abernathy, 1975).

However, it is also possible that cultural differences drive some societies to invent more than others. Wallace (1970) found that culture affects the inquisitiveness of the members of a society and their tolerance for new ideas and therefore the rate of discovery and innovation. Shapero and Sokol (1982) observed that business formation rates vary from society to society because different cultures carry different beliefs about the desirability and feasibility of beginning a new enterprise. Moulin (1961) found that the number of Nobel Prize winners between 1901 and 1960 in physics, chemistry, medicine and physiology differs dramatically across 14 countries.

This study seeks to provide the first large-sample longitudinal analysis of how culture determines differences in rates of invention across societies. It compares Hofstede's (1980) measures of individualism and power distance with the per capita number of invention patents granted to nationals of 33 countries in 1967, 1971, 1976, and 1980.

Literature Review

Hofstede (1980) found that differences in national culture vary substantially along four dimensions: uncertainty avoidance, individualism, tolerance of power distance, and masculinity-femininity. Two of Hofstede's cultural dimensions - individualism and power distance - are theoretically linked to innovation and invention.

Power distance is the extent to which members of a society accept the unequal distribution of power in institutions and organizations. In power distant societies, class systems are considered normal and even desirable, and people are not expected to climb from one social class to another. By contrast, in non-power distant societies, equality among people is a driving force, authority is shared, and social mobility is common.

Why should power distance influence rates of invention and innovation? Allen (1970) and Utterback (1974) found that communication frequency is an important facilitator of innovation. Hage and Aiken (1970) found that an organizational structure which allows lower levels to participate in decisions facilitates the circulation of information, exposing decision makers to new technological innovations. Maidique (1980) found that the development of informal channels of communication and flexibility of oganizational structure is a unifying thread in innovation. By promoting informality in communications, the entrepreneurial heads of the executive structures help to perpetuate the fluidness, slack, and disorder that is necessary in the highly innovative initial stages of process development.

Hofstede (1980) found that power distance was associated with a lack of

informal communication between people of different hierarchical levels in organizations. The three statements which made up his power distance index were: "employees are afraid to disagree with their managers," "subordinates perceive that their boss takes decisions in an autocratic manner," and "subordinates prefer anything but a consultative style of decision making in their boss," (Hofstede, 1980: 103). Moreover, the following question cited by Hofstede (1980) and taken from Tannebaum's et al (1974) study of five small manufacturing plants in Austria, Italy, the United States, and Yugoslavia: "Is your supervisor inclined to take into account your opinions and suggestions?" is negatively correlated with the power distance index.

Other authors have also found that societies Hofstede describes as power distant are less likely to have information exchange between superiors and subordinates than are non power distant societies. Whyte (1969) explained that in a highly stratified society where power is concentrated in the hands of the superior, the subordinate learns that it can be dangerous to question the decisions of the superior. People learn to behave submissively, and do not thrash things out with their boss, face-to-face. Harbison and Burgess (1954) found that in France, Belgium and Italy, three countries more power distant than the U.S., upward communication is neither expected nor encouraged. Williams et al (1965) conclude that Peruvians are not as likely as Americans to see power and influence of workers over their work as being related to the participative communication practices of the supervisor.

Another characteristic of successfully innovating companies is their willingness to let any employee, regardless of position, champion new ideas. Knight (1987) found that in successfully innovating firms, employees believe that anyone can become an entrepreneur, and managers were adamant that the innovation champion should be the individual whose original idea it was. "This means that even the janitor should be able to champion an idea all the way through to its development.... If the person generating the idea is not the person who gets to run with it as champion, the chances for success are decreased dramatically, perhaps by as much as 50%." (Knight, 1987: 288).

This type of fluid structure, with a disregard for established hierarchies, is more likely in non-power distant societies than in power distant ones where the acquisition of power, wealth, and prestige are used to differentiate people and to reenforce the inequality between the members of a society. In these societies, those in power do not want to allow others to ignore differences because it reduces their power.

Moreover, Tushman (1977) notes that frame breaking change, an important stage in the innovation process, always alters the distribution of power in an organization. For example, at Prime and General Radio, corporate ventures caused the engineering functions to lose power, resources, and prestige as the marketing and sales departments gained. These dramatically altered power distributions reflect shifts in the bases of competition and resource allocation. In power distant societies in which people choose their positions to exert power over others, the shifts that result from innovation are socially unacceptable.

The psychological characteristics common to innovators and inventors are more common in non-power distant societies than in power distant ones. Collins and Moore (1970) developed a psychological profile which showed that the entrepreneurial personality is characterized by an unwillingness to submit to authority, an inability to work with it, and a consequent need to escape from it. Maidique (1980) explained that some potential entrepreneurs find ways to satisfy their psychological needs by pursuing - sometimes in unorthodox ways - high risk projects within the organization; others finally break away to create a new structure.

Sexton and Bowman (1985) concluded that entrepreneurs need autonomy, independence, and dominance, and are not strongly absorbed by needs for support for others or conformity to the norms of others. Hofstede found that the power distance index is positively correlated (rho=.8) with conformity on Gorden's Value Index, which defines it as as doing what is socially correct, following regulations closely, doing what is accepted and proper, and being a conformist.

Hornaday and Aboud (1971) reported that in comparison to other people in general, entrepreneurs and innovators had higher needs for achievement and higher scores for independence and effectiveness of leadership scales in Gordon's Survey of Interpersonal Values. Hofstede (1980) compared his power distance index to Gordon's (1976) Survey of Interpersonal Values and found that over the 17 countries of overlap between the two sets, power distance was negatively correlated (rho= -.79) with independence. This suggests that innovative behavior is associated with a lack of power distance.

Knight (1987) explains that a corporate venturer is ideally chosen by self-selection. He should not be delegated, but should choose himself to be the leader and champion an innovation. Hofstede's power distance index is also positively correlated (rho=.54) with Haire's subscale on leadership and initiative, which states that leadership skills can be acquired by most people regardless of their particular inborn traits and abilities.

Knight (1987) found that in successful corporate venturing, the amount of control exercised over the entrepreneur should be relatively loose. He or she should have the final say on what should be done. Tight control tends to frustrate entrepreneurial personalities; and when the control exercised was very tight and constraining, the project was more likely to fail.

Hofstede (1980) explained that a small power distance leads to the feasability of control systems based on trust in subordinates; in larger power distance countries such trust is missing, and control systems are more elaborate. Thus, the loose reigns necessary for innovation and invention are easier to implement in non-power distant societies.

Individualism stands for a preference for a loosely knit social framework in which people are supposed to take care of themselves and their immediate families only. Group orientation stands for a preference for a tightly knitted social framework in which individuals are emotionally integrated into an extended family, clan or other in-group,

which will protect them in exchange for unquestioning loyalty.

Historically, societies have depended on the individual inventor/entrepreneur for many of their most startling inventions (Mansfield, 1968); and, a rich literature exists on heroic, independent, technological entrepreneurs (Maidique, 1980). This relationship is intriguing given that Hofstede (1980) found that respondents in individualistic, but not collectivist societies, were likely to answer that a larger corporation is not a more desirable place to work than a small company.

In the large firm as well as the new business, the individual is the central figure in successful technological innovation (Roberts, 1969). In his study of radical military innovations, Schon (1963) observed that certain committed individuals, champions, played the key role in successful innovations. Schon lists some fifteen major inventions of the twentieth century, such as the jet engine and the gyrocompass, in which individuals played a major role.

Inventors and innovators also appear to behave in an independent manner. Knight (1987) explained that corporate venturers tend to behave very much like independent entrepreneurs, especially in their desire for independence. The greatest difficulty expressed by those he interviewed was in getting the entrepreneurs or champions to behave as team players, to interact with other functional area personnel, and to recognize the importance of all these skills in the success of the innovation.

It may be that independence is more common in some cultures than in others. Hofstede (1980) found that the individualism index correlates rho=.91 with the self description of going one's own way without minding others. It also correlates rho=.60 with Haire et al's (1966) management motivations and satisfactions questionnaire items on stronger need for autonomy, weaker need for security, freedom as a work goal, and the taking of individual initiative.

Azumi et al. (1986) argue that innovation seems to require more individual freedom and professional career development, and is less likely to occur in a more mechanistic organization, which is bureaucratically structured and heavily reliant upon automated machinery in industrial settings. Schon (1966) explained that new venturing is up against a significant and very natural resistance in existing organizations. Organizations build high commitment to existing products and processes to reduce disruption and to increase operating efficiency. Thus, as Hlavacek and Thompson (1975) argued, the bureaucratic nature of organizations acts to protect and reestablish the status quo, stifling the venturing effort.

Quinn (1979) explained that the sharing of information is an important characteristic of innovative companies. Inventions and innovations require people working on projects to share information with everyone concerned, even if they are not part of one's social group. Hofstede (1980) found that people in individualistic cultures are more likely to share information than are people in group-oriented cultures; and Haire

et al's (1966) subscale on the importance of sharing information and objectives among managers in 19 countries was positively correlated (r=0.63) with individualism.

Finally, the Horatio Alger myth of the self-made man indicates that people become successful inventors because they see such activity as improving their position in society. Weber (1958) argued that the caste system and its series of obligations reduce occupational mobility, technical change, and innovation, which are considered to be objectionable and ritually dangerous. In a society which emphasizes that each person has a duty appropriate to his station in life - a duty which depends on the class or caste into which he is born, very little variability would seem possible. In short, if people in a society do not feel that they cannot change the position into which they are born, there will be little innovation and invention in that society.

Hofstede found strong correlations between individualism and social mobility. Spearman rank correlations of individualism to Cutright's (1968) measure of occupational inheritance (a measure of the ease of access to middle-class positions of people, regardless of their father's profession: individual careers not being constrained by family background) were rho=-.71. Miller's (1960) index of inequality of opportunity (which measures the ease of access of sons to the category of nonmanual workers if their father is either a nonmanual or a manual worker) was correlated rho=-.50 with individualism.

One study deserves special mention here because it shows the relationship between innovation and both of Hofstede's measures. Schumpeter (1934) linked innovation to the entrepreneur, arguing that the source of private profits is successful innovation, and that innovation is the essence of the development process. McClelland (1967) found a significant positive relationship between need for achievement scores and subsequent rates of economic growth in a cross-national sample in the twentieth century. He also found that people with high need for achievement scores are more likely to behave like entrepreneurs; and his empirical evidence suggests that persons with high need for achievement tend to be attracted into entrepreneurial positions. Hofstede (1980) compared his indices with McClelland's need for achievement scores on children's readers and found Spearman rank correlations of rho=-.58 with the power distance index, and rho=.44 with the individualism index.

Hypotheses

This study examines four hypotheses about the causes of invention:

H1: There will be a positive relationship between individualism scores and per capita rates of invention across societies.

H2: There will be a negative relationship between power distance scores and per capita rates of invention across societies.

H3: The relationships between individualism scores and

power distance scores on the one hand and per capita rates of invention on the other will hold even when rates of invention are adjusted for wealth (as is explained below).

H4: The relationship between individualism scores and power distance on the one hand and per capita rates of invention on the other will hold across time.

Methodology

This study looks at the inventiveness of countries by examining data on the per capita number of inventions patented by nationals of 33 countries in the years 1967, 1971, 1976, and 1980. Numbers of inventions patented are a good measures of inventiveness because, according to Evenson (1984: 91), "Three fundamental requirements must be met by an invention to qualify for the standard invention patent (1) the invention must be 'novel' (2) the invention must be 'useful' (3) the invention must exhibit an 'inventive step' (i.e., it must be unobvious to practitioners skilled in the technology field)."

The independent variables are taken from Hofstede's (1980) study. This work surveyed 88,000 employees in more than 40 overseas subsidiaries of a major American corporation. From the questionnaire data, Hofstede created ordinal scales for countries for each of four cultural dimensions based on a standardized factor analysis of questionnaires. Bias for differences in occupational positions among subsidiaries was controlled. As the study consisted of two questionnaires separated by a four year interval, it was possible to test for the reliability in scores over time; only questions showing greater than .5 correlation in scores were used to derive the scales. This study uses the scores from two of the dimensions: power distance and individualism. Appendix 1 shows these scores.

The dependent variable is the per capita number of invention patents granted to nationals, taken from Evenson's (1984) data. These data were calculated from various issues of *Industrial Property Statistical Report.* For the purposes of this study, they were divided by the *International Financial Statistics'* figures on population for the relevant countries and years to provide a standardized figure for the per capita number of invention patents granted to nationals in the four years under study. Appendix 2 shows this data.

In his product cycle theory, Vernon (1966, 1970) argued that innovations tend to occur in wealthier nations which have a need for labor saving devices. Hofstede (1980) argued that greater wealth presupposes higher technology, and found that there were correlations of 0.82 between individualism and per capita GNP, and correlations of -0.65 between power distance and per capita GNP. Therefore, a fair examination of the effect of culture on rates of invention must hold wealth constant.

The ratio of invention patents to GNP for the 33 countries was calculated to give a figure of how many invention patents are associated with each dollar of GNP across the 33 countries in the study. This figure, calculated according to the formula outlined in Appendix 3, was

multiplied by the per capita GNP for each country for each of the four years the data was collected. This yielded the predicted number of invention patents per capita based on the wealth of the society. The actual number of invention patents per capita was divided by the predicted number of invention patents to yield an index of invention patents per capita with wealth held constant. This data is shown in Appendix 4.

Because the independent variables in this study were ordinal scales created from answers to questionnaires about values, it is not likely that there is a direct link between units of individualism or power distance, and units of invention per capita. Therefore, the data were analyzed through the use of spearman rank correlations between the country scores on Hofstede's scales and the numbers of inventions/capita both unweighted and weighted for wealth (using the formula described above and shown in appendix 3).

Results

As the first correlation matrix indicates, the per capita rate of invention across societies is consistent over time. The lowest correlation between inventions per capita for any two time periods is .896, for 1967 and 1980. By contrast, the highest, between rates of invention per capita in 1976 and 1980, is .975.

Table 1

Spearman Rank Correlations Between Per Capita Rates of Invention Measured in 1967, 1971, 1976, and 1980

	1980	1976	1971	1967
1980	1.000			
1976	0.975	1.000		
1971	0.962	0.966	1.000	
1967	0.896	0.944	0.953	1.000

Similarly, strong positive correlations across the four years studied were found for inventions per capita adjusted for wealth. These ranged from a low of 0.79 between 1967 and 1980, to a high of 0.95 between 1976 and 1980. The second correlation matrix shows this data.

Table 2

Spearman Rank Correlations of Per Capita Rate of Inventions Adjusted For Wealth Measured in 1967, 1971, 1976, and 1980

	1980	1976	1971	1967	Average
1980	1.000				
1976	0.950	1.000			
1971	0.893	0.893	1.000		
1967	0.790	0.838	0.885	1.000	
Average	0.928	0.946	0.960	0.945	1.000

Significant rank correlations were found between per capita rates of invention, and individualism and lack of power distance across the four time periods. Rank correlations between individualism and per capita rates of invention ranged from rho=.551 in 1980 to rho=.654 in 1967. Rank correlations between power distance and per capita rates of invention ranged from rho=-.541 in 1967 to rho=.-618 in 1980. Table 3 shows this data.

Table 3

Correlations Between Hofstede's Indices and Inventiveness
N=33

1967				
	Measure	Rho	t-Value	Two-Sided Sig. Level
	IDV	.654	4.82	.001
	PDI	-.541	-3.58	.01
1971				
	Measure	Rho	t-Value	Two-Sided Sig. Level
	IDV	.611	4.30	.001
	PDI	-.547	-3.64	.001
1976				
	Measure	Rho	t-Value	Two-Sided Sig. Level
	IDV	.596	4.15	.001
	PDI	-.563	-3.80	.001
1980				
	Measure	Rho	t-Value	Two-Sided Sig. Level
	IDV	.551	3.68	.001
	PDI	-.618	-4.38	.001

When the data on inventiveness are adjusted for wealth, the relationships between number of inventions per capita and individualism and lack of power distance are weaker, but remain significant. The correlations are rho=.408 for individualism and per capita inventiveness and rho=-.380 for power distance and per capita inventiveness when the data are averaged over the 13 year period. As Table 4 shows, the relationship between individualism and per capita inventiveness ranges from rho=.387 in 1971 to rho=.423 in 1980. The relationship between power distance and inventiveness ranges from rho=-.327 to rho=-.515.

Table 4

Correlations Between Hofstede's Indices and Inventiveness Adjusted for Wealth
N=33

1967				
	Measure	Rho	t-Value	Two-Sided Sig. Level
	IDV	.408	2.49	.02
	PDI	-.327	-1.93	.10

1971

Measure	Rho	t-Value	Two-Sided Sig. Level
IDV	.387	2.34	.05
PDI	-.354	-2.11	.05

1976

Measure	Rho	t-Value	Two-Sided Sig. Level
IDV	.416	2.55	.02
PDI	-.445	-2.77	.01

1980

Measure	Rho	t-Value	Two-Sided Sig. Level
IDV	.423	2.60	.02
PDI	-.515	-3.35	.01

Average

Measure	Rho	t-Value	Two-Sided Sig. Level
IDV	.408	2.49	.02
PDI	-.380	-2.29	.05

Conclusion

What do we conclude from the data? First, countries that are inventive at one point in time appear to remain inventive, while those which are not inventive remain uninventive. This relationship tends to hold even when inventiveness is adjusted for wealth.

Having made this statement, it is appropriate to add a word of caution. The data do suggest that countries can change their degree of inventiveness over time. The rank correlations of per capita inventiveness between 1967 and 1980 are weaker than those between 1976 and 1980. Moreover, per capita rates of inventiveness, particularly after they have been adjusted for wealth, are stable only for about two thirds of the sample. Other nations have greatly shifting per capita rates of inventiveness over time.

Second, the inventiveness of a society seems to be explained by its degree of individualism and lack of power distance. The more individualistic the people of a society are, the more likely they are to invent. The less power distant the social structure is, the more likely people are to invent. This occurs whether or not wealth is controlled.

One important weakness of this study is that changes in cultural values could not be examined. Hofstede's monumental data collection effort measured values at one point in time, and his study did not show differences in rankings of cultures across time. It may be that the shifts in the degree of countries' inventiveness shown in the data may have occured in response to shifts in power distance and individualism. Kerr et al (1960) argued that technology will lead all countries to converge in their values, as the logic of industrialism will lead us to a society in which ideology will cease to matter. If this is true, then countries industrializing faster should experience greater change in their values. Thus, it is possible for countries to have become more individualistic and less power distant during the period when they became more inventive. Unfortunately, wthout replication of Hofstede's survey of values, we can only speculate.

The fact that rates of inventiveness can change over time begs the question: Is it possible to increase the inventiveness of a society? The answer is beyond the scope of this research. This paper suggests that inventiveness is linked to individualism and power distance, but does not explain how a country can change its degree of individualism or power distance to increase inventiveness. Does this occur through contact with other cultures? Or is it a result of deliberate policies of businesspeople and government officials?

The ramifications of cultural differences on rate of inventiveness are great, ranging from influencing where managers should locate research and development in a global corporation to the rate of economic development of countries in the next century. Moreover, since cultural change might explain changes in inventiveness, as people in group-oriented Asian countries become more individualistic, they may become more inventive, changing the basis for their competitive advantage. Therefore, it is hoped that this study will spur other scholars to examine the relationship between cultural traits and innovation and inventiveness.

Appendix 1

Scores on Hofstede's Indices

Country	IDV	PDI
Argentina	46	49
Australia	90	36
Austria	55	11
Belgium	75	65
Brazil	38	69
Canada	80	39
Chile	23	63
Colombia	13	67
Denmark	74	18
Finland	63	33
France	71	68
Great Britain	89	35
Germany	67	35
Greece	35	60
India	48	77
Ireland	70	28
Israel	54	13
Italy	76	50
Japan	46	54
Mexico	30	81
Netherlands	80	38
Norway	69	31
New Zealand	79	22
Philippines	32	94
Portugal	27	63
Singapore	20	74
Spain	51	57
Sweden	71	31
Switzerland	68	34
Turkey	37	66
USA	91	40
Venezuela	12	81
Yugoslavia	27	76

Appendix 2

Number of Inventions Per Capita Multiplied By One Million

Country	1980	1976	1971	1967
Argentina	46.3	48.31	55.92	53.83
Australia	43.4	64.13	75.66	63.73
Austria	163.6	155.48	164.88	162.3
Belgium	85.4	105.3	139.09	165.55
Brazil	3.0	4.08	4.51	3.07
Canada	63.4	56.49	73.51	61.88
Chile	5.5	5.79	6.09	9.04
Colombia	1.4	1.24	2.94	2.58
Denmark	37.6	40.86	50.81	69.83
Finland	91.5	61.39	75.76	50.11
France	157.9	158.42	267.24	307.69
Great Britain	158.4	151.23	186.59	178.96
Germany	160.6	169.3	135.1	85.62
Greece	119.8	144.88	138.96	111.81
India	0.76	0.69	1.2	0.85
Ireland	7.3	8.62	5.37	9.62
Israel	80.3	55.4	65.8	66.42
Italy	31.9	*	80.0	172.32
Japan	328.7	285.13	234.24	137.63
Mexico	2.7	4.7	7.86	43.38
Netherlands	29.8	26.71	24.11	25.56
Norway	67.3	51.98	98.97	59.37
New Zealand	42.8	67.85	*	*
Philippines	1.76	2.42	1.21	0.47
Portugal	9.7	4.72	23.8	9.63
Singapore	0.42	*	0.95	2.53
Spain	40.1	55.02	59.83	84.26
Sweden	168.0	228.85	277.16	225.67
Switzerland	226.9	550.1	668.54	899.5
Turkey	0.8	0.84	1.44	0.92
USA	166.2	200.52	269.61	258.03
Venezuela	3.8	3.68	22.34	4.4
Yugoslavia	2.62	2.69	6.95	8.72

Appendix 3

Formula for Calculating Actual Number Inventions Per Capita as a Percentage of Expected Number of Inventions Per Capita Expected Based on Wealth

1. $$\frac{\frac{\Sigma \text{ Inventions/Population}}{n}}{\frac{\Sigma \text{ GNP Per Capita}}{n}} = \text{Expected Number of Inventions Per Dollar of GNP}$$

2. Expected Number of Inventions Per Dollar of GNP • GNP Per Capita For X = Expected Number of Inventions For Country X

3. $$\frac{\text{Actual Number of Inventions Per Capita}}{\text{Expected Number of Inventions Per Capita}} = \text{Index Value in Appendix 4}$$

Appendix 4

Number of Inventions Per Capita Adjusted For Wealth
Multiplied By One Million

Country	1980	1976	1971	1967	Average
Argentina	185	155	129	135	151
Australia	43	43	49	44	45
Austria	169	168	149	167	163
Belgium	70	97	112	143	106
Brazil	15	18	20	16	17
Canada	58	46	48	45	49
Chile	29	24	15	23	23
Colombia	12	9	18	17	14
Denmark	28	32	31	45	34
Finland	100	49	61	46	64
France	142	139	193	246	180
Great Britain	223	153	147	140	166
Germany	123	141	89	64	104
Greece	273	338	276	273	290
India	36	28	35	27	32
Ireland	16	17	8	16	14
Israel	173	91	86	112	91
Italy	54	*	96	223	124
Japan	332	327	222	166	249
Mexico	15	23	31	187	64
Netherlands	26	23	16	19	21
Norway	56	39	63	38	49
New Zealand	65	77	*	*	71
Philippines	26	32	13	6	19
Portugal	40	20	85	40	46
Singapore	1	*	2	4	2
Spain	82	98	90	47	80
Sweden	125	154	147	126	138
Switzerland	145	381	279	352	289
Turkey	5	6	8	6	6
USA	140	145	156	145	147
Venezuela	11	9	47	10	19
Yugoslavia	10	11	23	35	20

References

Allen, T. (1970). Roles in technicago communication networks. In C. Nelson and D. Pollack (Eds) *Communication Among Scientists and Engineers.* Lexington, MA: Heath.

Azumi, K., F. Hull, and R. Wharton. (1986) Organization design in Japan and versus America: A preliminary comparison, in S. Clegg, D. Punphy, and S. Redding (Eds.),*The Enterprise and Management in East Asia* . Hong Kong: Univ. of Hong Kong.

Collins, O., and D. Moore. (1970). *The Organization Makers.* New York: Appleton-Century-Croft.

Cutright, P. (1968). Occupational inheritance: A cross-national analysis, *American Journal of Sociology*, 73: 400-416.

Evenson, R. (1984). International invention: Implications for technology market analysis, in R. Griliches (Ed.) *R&D, Patents, and Productivity.* Chicago: University of Chicago Press.

Gordon, L.V. (1976) *Survey of Interpersonal Values - Revised Manual.* Chicago: Science Research Associates.

Hage, J., and M. Aiken. (1970). *Social Change in Complex Organizations.* Random House, New York.

Haire, M., Ghiselli, E.E., and L.W. Porter. (1966). *Managerial Thinking: An International Study*, New York: John Wiley.

Harbison, F.H., and E.W. Burgess. (1954). Modern management in Western Europe, *American Journal of Sociology*, 60: 15-23.

Hlavacek, J. and V. Thompson. (1975) Bureaucracy and venture failure, *Academy of Management Review*, April.

Hofstede, G. (1980) *Culture's Consequences: International Differences in Work Related Values.* Beverly Hills, CA: Sage Publications.

Hornaday, J., and J. Aboud. (1971). Characteristics of successful entrepreneurs, *Personnel Psychology*, 24: 141-153.

Kerr, C., Dunlopp, J., Harbison, F., and C. Meyers. (1960). *Industrialism and Industrial Man: The Problems of Labor and Management in Economic Growth.* London: Heinemann.

Knight, R. (1987). Corporate innovation and entrepreneurship: A Canadian study, *Journal of Product Innovation Management,* 4: 284-297.

McClelland, D.C. (1967). *The Achieving Society.* Princeton, NJ: Van Nostrand, Reinhold.

Maidique, M. (1980) Entrepreneurs, champions, and technological innovation, *Sloan Management Review*, 21 (2):59-76.

Mansfield, E. (1968). *Industrial Research and Technological Innovation.* New York: Norton.

_____. (1971). *Research and Innovation in the Modern Corporation.* Norton: New York.

_____. (1981). How economists see R&D, *Harvard Business Review*, 59, November December: 98-106.

Miller, S. (1960). Comparative social mobility, *Current Sociology*, 9: 1-89.

Moulin, L. (1961). La nationalite des Prix Nobel de 1901 a 1960, *Cahiers Internationaux de Sociologie*, 31: 145-163.

Myers, S., and D. Marquis. (1969). *Successful Industrial Innovations.* National Science Foundation, Washington, D.C.

Quinn, J. (1979) Technological innovation, entrepreneurship and strategy,

Sloan Management Review, Spring: 19-30.
Roberts, E. (1969). Entrepreneurship and technology, in W.H. Gruber and D.G. Marquis (Eds.),*The factors in the Transfer of Technology*. Cambridge, MA: MIT Press.
Roberts, E. (1980) New ventures for corporate growth, *Harvard Business Review*, July-August: 134-142.
Schon, D. (1966). The fear of innovation, *International Science and Technology,* 14, November: 70-78.
Schumpeter, J. (1934). *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
Schwartz, S., and I. Vertinsky. (1980). Information preferences and attention patterns in R&D investment decisions, in D. Sahal (ed.) *Research Development and Technological Innovation*. Lexington Books, Lexington, MA.
Sexton, D. and N. Bowman. (1985). The entrepreneur: A capable executive and more, *Journal of Business Venturing*, 1 (1): 129-140.
Shapero, A., and L. Sokol. (1982). The social dimensions of entrepreneurship. In C. Kent , D. Sexton, K. Vesper (Eds.), *Encyclopedia of Entrepreneurship*. Englewood Cliffs, NJ: Prentice Hall.
Tushman, M. (1977). Special boundary roles in the innovation process, *Administrative Science Quarterly*, 22: 587-605.
Utterback, J. (1974). Innovation in industry and the diffusion of technology, *Science*, 183: 620-626.
Utterback, J., and W. Abernathy. (1975). A dynamic model of process and product innovation, *Omega*, 3, December: 639-656.
Vernon, R. (1966). International investment and international trade in the product cycle. *Quarterly Journal of Economics*.
Vernon, R. (1970). *The Technology Factor in International Trade*. New York: National Bureau of Economic Research.
Wallace, A. (1970). *Culture and Personality*. New York: Random House.
Weber, M. (1958). *The Religion of India - The Sociology of Hinduism and Buddhism*. New York: The Free Press.
Whyte, W.F. (1969). Culture and work, in R.A. Webber (ed.), *Culture and Managment*, Homewood, Ill: Irwin.
Williams, L.K., Whyte, W.F., and C.S. Green. (1965) Do cultural differences affect workers' attitudes?, *Industrial Relations*, 5: 105-117.