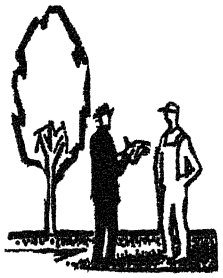

THE CONSTRUCTION OF INNOVATIVENESS SCALES

by

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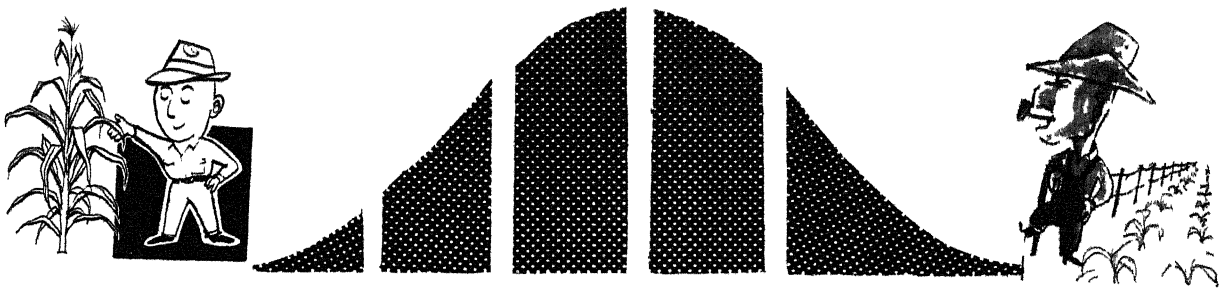

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The present bulletin is one in a series of three related bulletins which deal with the diffusion of new ideas.

Mimeo Bulletin AE 328. Everett M. Rogers, Bibliography on the Diffusion of Innovations.

Mimeo Bulletin AE 329. A. Eugene Havens, A Review of Factors Related to Innovativeness.

Mimeo Bulletin AE 330. Everett M. Rogers, A. Eugene Havens, and David G. Cartano, The Construction of Innovativeness Scales.

THE CONSTRUCTION OF INNOVATIVENESS SCALES*

by

Everett M. Rogers, A. Eugene Havens, and David G. Cartano**

Within recent years rural sociologists and others have devoted considerable effort in attempts to measure the degree of innovativeness possessed by individuals. Innovativeness is the degree to which an individual is relatively earlier to adopt new ideas than the other members of his social system.

Since 1941, at least 26 different studies by rural sociologists have attempted to measure innovativeness with scales composed of new farm ideas.*** A lack of consensus in the construction of these innovativeness scales has prevailed. Only four of the 26 innovativeness scales contained more than 14 items. The relatively small number of items suggests that the innovativeness scales may have insufficient reliability. Only two of the 26 scales provided heavier weighting for earlier dates of adoption of innovations. The other 24 scales simply awarded one point for adoption and zero for non-adoption of an innovation.

In a recent review of the 26 studies using innovativeness scales, Rogers and Rogers**** concluded that adequate measures of innovativeness must contain a larger number of items. They further suggested that not only should

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***These innovativeness scales are reviewed by Everett M. Rogers and L. Edna Rogers, "A Methodological Analysis of Adoption Scales," Rural Sociology. 26: 325-336, 1961.

****Ibid.

data be obtained about the number of innovations adopted, but the relative time of adoption of each new idea should also be utilized in innovativeness scales. Lastly, Rogers and Rogers concluded that allowance should be made for items that do not apply to all individuals.

The present authors have received many inquiries about the exact steps involved in constructing and computing innovativeness scales. The present report is an attempt to explain one method of measuring innovativeness by an adoption-of-innovations scale which includes an adequate number of items, provides weightings for earlier adoption of new ideas, and allows for items that do not apply to all individuals. There is no attempt to present statistical evidence of the reliability, validity, unidimensionality, and internal consistency of innovativeness scales. However, such evidence is available, and is reviewed by Rogers and Rogers*. The purpose of the present report is to present in a systematic and logical sequence one method which may be utilized to construct innovativeness scales.

Step 1 - Selection of Items for an Innovativeness Scale

The initial step in building an innovativeness scale is to determine which new ideas to include as items. It is generally suggested that items be included which most of the respondents to be studied could adopt. If one is studying a specialized type of farming, such as dairying, one should include innovations which would apply to dairy farmers. There is little agreement on exactly how many items to include in innovativeness scales; however, the present authors suggest a minimum of 14 or 15 items.**

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*Ibid.

**For justification of this number of items on the basis of minimum levels of reliability, see Rogers and Rogers, ibid.

Step 2 - Item Response

As soon as the number and type of items to be included in an innovativeness scale have been determined, one is ready to collect the data. Respondents should be asked to indicate (1) what date they first used the innovation if they have adopted, (2) that they have not used the innovation and that it is not applicable to their situation, or (3) that the innovation is applicable to their situation but they have not adopted it. Therefore, there are three possible responses for each item (1) the date the innovation was first used, (2) the innovation "doesn't apply", or (3) the innovation has not been adopted but does apply.*

Step 3 - Array the Adoption Dates

Once data are collected for each item included in an innovativeness scale, it is necessary to determine the range of adoption dates for each innovation. Two farm ideas will be utilized for illustrative purposes. They are 2,4-D weed spray and Clintland oats variety. In the present example, the number of respondents is 145. A table should be constructed as the next step in the development of an innovativeness scale to show both (1) the number of adopters of an innovation each year, and (2) the cumulative number of adopters each year (See Table 1).

Step 4 - Converting the Raw Data to Standard Scores

The raw data in Table 1 should next be converted to "sten" scores, one type of standard scores. Converting data to standard form has two advantages (1) all raw data are converted to continuous, single-digit form, and (2) the resulting scores are normally distributed. Table 2 shows the percentage of the total number of respondents (for which the innovation applies) that

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*See the Appendix for an example of an innovativeness scale as it appeared in an interview schedule.

Table 1. Time of Adoption of Two New Farm Ideas, 2,4-D Weed Spray and Clintland Oats Variety

Date of Adoption	2,4-D Weed Spray		Clintland Oats Variety	
	Number of Adopters Each Year	Cumulative Number of Adopters	Number of Adopters Each Year	Cumulative Number of Adopters
1944	2	2	0	0
1945	1	3	0	0
1946	6	9	0	0
1947	2	11	0	0
1948	5	16	1	1
1949	10	26	0	1
1950	16	42	4	5
1951	20	62	3	8
1952	6	68	1	9
1953	18	86	0	9
1954	9	95	1	10
1955	11	106	9	19
1956	11	117	16	35
1957	4	121	15	50
1958	1	122	27	77
1959	2	124	12	89
1960	3	127	11	100
1961	3	130	7	107
Never Adopted	15	145	16	123
Doesn't Apply	0	-	22	-
Total	145	-	145	-

should be assigned each sten score,* ranging from "0" to "9". It is important to note that it is the different percentages of respondents assigned to each sten score category that transforms the distribution of adoption dates for each innovation shown in Table 1 into a normal distribution.

Beginning with the individuals who had the earliest adoption dates, use column 4 of Table 2 as a guide for the number of persons to be assigned the highest sten score of "9". Assign sten scores on a cumulative basis to the respondents. For example, the 3 farmers shown in Table 1 who adopted 2,4-D weed spray in 1944 and those who adopted in 1945 receive a sten score of "9" for that innovation (Table 3). Similarly, the six farmers adopting 2,4-D weed spray in 1946 receive a sten score of "8". The 2 farmers adopting in 1947 and the 5 adopting in 1948 are assigned a sten score of "7". Six of the 10 farmers adopting 2,4-D weed spray in 1949 have a sten score of "7" and 4 farmers have a sten score of "6", so all 10 respondents are assigned a sten score of "7", due to rounding of fractions to the nearest whole number.

The 15 respondents shown in Table 1 who have not yet adopted 2,4-D weed spray are obviously less innovative than the 130 farmers who have adopted the innovation. Table 2 indicates that 6 of the 15 farmers should receive a sten score of "2", 6 farmers should receive "1", and 3 farmers a score of "0". But these 15 farmers should be given the same score. When their scores are averaged and rounded to the nearest whole number, all 15 non-adopters are assigned a sten score of "1" (Table 3).

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*These percentages, and a discussion of sten scores, comes from A. A. Canfield, "The 'Sten' Scale: A Modified C Scale," Educational and Psychological Measurement, 11:295-298, 1951; and Charles H. Coates and Alvin L. Bertrand, "A Simplified Methodology for Developing Multi-Measure Indices as Research Tools," Rural Sociology, 20:132-141, 1955.

Table 2. Sten Score Guide Utilized in Converting Raw Data to Sten Scores

Sten Score	Percentage of Respondents Receiving Each Sten Score	Cumulative Percentage of Respondents	Number of Respondents Receiving Each Sten Score when Sample Size Is 145	Cumulative Number of Respondents When Sample Size Is 145	Number of Respondents Receiving Each Sten Score when Sample Size Is 123	Cumulative Number of Respondents When Sample Size is 123
9	2.3	2.3	3	3	3	3
8	4.4	6.7	6	9	5	8
7	9.2	15.9	13	22	11	19
6	14.9	30.8	22	44	18	37
5	19.2	50.0	28	72	24	61
4	19.2	69.2	29*	101	25*	86
3	14.9	84.1	22	123	18	104
2	9.2	93.3	13	136	11	115
1	4.4	97.7	6	142	5	120
0	2.3	100.0	3	145	3	123
Total	100.0	-	145*	-	123*	-

*Due to rounding to the nearest whole number, the total adds to 144; therefore, one of the largest categories was increased so that the distribution totals 145.

Table 3. Sten Scores Assigned to Respondents for 2,4-D Weed Spray And Clintland Oats*

Date of Adoption	2,4-D Weed Spray		Clintland Oats	
	Number of Respondents	Sten Score Assigned	Number of Respondents	Sten Score Assigned
1944	2	9	0	-
1945	1	9	0	-
1946	6	8	0	-
1947	2	7	0	-
1948	5	7	1	9
1949	10	7	0	-
1950	16	6	4	8
1951	20	5	3	8
1952	6	5	1	7
1953	18	4	0	7
1954	9	4	1	7
1955	11	3	9	7
1956	11	3	16	6
1957	4	2	15	5
1958	1	2	27	4
1959	2	2	12	4
1960	3	2	11	3
1961	3	2	7	2
Never Adopted	15	1	16	1
Total	145	-	123	-

*It will be noted that the frequencies reported in Table 3 do not correspond indentically with the frequencies called for in the sten score guide (Table 2) due to rounding to the nearest whole number.

Table 1 indicates that 2,4-D weed spray was applicable to all 145 respondents in the present study, so the sten score guide reported in Table 2 is appropriate. However, Table 1 further indicates that Clintland oats variety was not applicable for 22 respondents. These 22 farmers purchased all their feed and their land was entirely in pasture. Therefore, they had no opportunity to adopt Clintland oats. Consequently, the number of respondents receiving a certain sten score should be based on a sample size of 123 (instead of 145) in the case of Clintland oats variety. By re-adjusting the sample size from 145 to 123 (Table 2 and 3) on the basis of applicability of the innovation, those farmers for whom the innovation is not applicable are not penalized for non-adoption.

Step 5 - Computing Respondents' Innovativeness Scores

The final step is to compute an innovativeness score for each of the 145 respondents on the basis of the two farm ideas. Total scores are simply determined by adding the sten score received by each respondent for each item included in the innovativeness scale, and dividing by the number of items applicable to his situation. For example, if farmer A received a sten score of "9" for 2,4-D and "7" for Clintland oats variety, his innovativeness score would be $\frac{9+7}{2}$ or 8. If respondent B received a score of "5" for 2,4-D weed spray, and Clintland oats variety was not applicable to his enterprise, his innovativeness score would be 5. The present illustration using two items in an innovativeness scale can easily be extended to the case where 15, 20, or 25 items are included in the scale.

The present method for constructing innovativeness scales has been utilized in several recent studies. A question may be raised as to the nec-

essity for including time of adoption of ideas in innovativeness scales. Rogers and Rogers* found in one study that approximately 30 per cent of the variation in innovativeness scores is not accounted for unless time of adoption is included in innovativeness scales.

It is hoped that the present report has adequately demonstrated one method of developing innovativeness scales.

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*Ibid.

APPENDIX

AN INNOVATIVENESS SCALE TAKEN FROM AN INTERVIEW SCHEDULE

We are interested in your time of adoption of new products. What year did you first use...

Practice	Year adopted (or) Doesn't apply (or) Never adopted	Sten Score
1. 2,4-D spray for weed control?		
2. Amino Triazole to spray Canadian thistles?		
3. Clintland (not Clinton) variety of oats?		
4. Decon or warfarin for rat control?		
5. Automatic washing of dairy equipment (in place)?		
6. Pipeline milking system?		
7. Lindane or Benzene Hexachloride for hog mange control?		
8. Stilbestrol in beef feeding?		
9. A systemic insecticide for cattle grubs?		
10. Elevated stanchions?		
11. Bulk feed delivery (in bulk bin rather than in sacks)?		
12. Herringbone system (for milk stalls)?		
13. Artificial breeding for dairy cows?		
14. Bulk milk tank?		

Innovativeness Score_____