Réjean Landry
Moktar Lamari
Nabil Amara
Université Laval

The Extent and Determinants of the Utilization of University Research in Government Agencies

This article addresses three questions: To what extent is university research used in government agencies? Are there differences between the policy domains in regard to the extent of use? What determines the use of university research in government agencies? The data analysis is based on a survey of 833 government officials from Canadian government agencies. Comparisons of the magnitude of uptake of university research show large and significant differences across policy domains. The results of the multivariate regression analyses show that the characteristics of research and the focus on the advancement of scholarly knowledge or on users' needs do not explain the uptake of research. Users' adaptation of research, users' acquisition efforts, links between researchers and users, and users' organizational contexts are good predictors of the uptake of research by government officials.

This article addresses three questions: To what extent is university research used in government agencies? Are there differences across policy domains in regard to the extent of use? What determines the use of university research in government agencies? The use of research evidence in government agencies is based on the idea that informing decisions with research findings is likely to help eliminate inefficient uses of resources or wrong decisions. Although there is an expanding body of conceptual and empirical studies on the use of research in government agencies, these studies tend to suffer from four methodological problems that Mandell and Sauter (1984) identified 19 years ago: composition of the study population; specification of the dependent variable "use"; problems associated with the independent variables considered; and problems resulting from the failure to appreciate respondents' inability to report and explain their behavior accurately. Some of these methodological problems exist because, despite several attempts to develop conceptual models for explaining the use of research (Sabatier 1978; Beyer and Trice 1982; Bozeman 1986; Huberman 1987; Webber 1987; Lester and Wilds 1990; Lester 1993; Oh and Rich 1996; Oh 2000; Landry, Amara, and Lamari 2001), there is not yet an integrated conceptual model used by the experts in the field of knowledge utilization.

This article first reviews the major methodological problems of the field of knowledge utilization to indicate how the present study deals with them. Then it applies conceptual models and methodological solutions likely to alleviate those problems to data about how professionals and managers in Canadian and provincial government agencies use university research in their professional activities. The article concludes by stressing the major findings of the study and their policy implications, as well as by pointing to issues that should receive attention in future investigations.

We know little about the factors that induce professionals and managers in government agencies to use university research in their professional activities. The purpose and contribution of this article is to identify the determi-

Réjean Landry *is a professor of management at Laval University in Quebec City. He holds a chair on the dissemination and uptake of research. Web site: http://www.fss.ulaval.ca/kuuc.* ***Email: rejean.landry@mng.ulaval.ca****.*

Moktar Lamari *has completed a doctorate in political science at Laval University. He is currently a senior policy evaluator at the Ministry of Research, Science and Technology in the Quebec government. Web site: http://www.fss.ulaval.ca/kuuc****. Email: Moktar.Lamari@mrst.gouv.qc.ca****.*

Nabil Amara *has completed a doctorate in political science at Laval University. He is currently a researcher and the Canadian Health Services Research Foundation chair on dissemination and uptake of research at Laval University in Quebec City. Web site: http://www.fss.ulaval.ca/kuuc.* ***Email: nabil.amara@mng.ulaval.ca****.*

nants of research utilization by extending the dominant explanatory models and by using data from a large-scale survey to look at the conditions under which professionals and managers in diverse policy domains and in many different government agencies use research knowledge. This article presents results of the first large-scale quantitative study on knowledge utilization in Canadian and provincial administrations. The survey covers the knowledge utilization activities of 833 professionals and managers.

Conceptual and Methodological Issues

Empirical studies on the utilization of research in government agencies tend to suffer from four conceptual and methodological problems (Mandell and Sauter 1984): composition of the study population; specification of the dependent variable "use"; problems associated with the independent variables considered; and problems resulting from the failure to appreciate respondents' inability to report and explain their behavior accurately. Let us tackle these problems in turn.

Composition of the Study Population

Samples based on single policy domains, single organizations, or single hierarchical levels are not likely to be generalizable because these dimensions represent important variations in the types of needs of research and the magnitude of use of research (Mandell and Sauter 1984). The sample of the present study is large, and it includes respondents from multiple policy domains, multiple federal and government agencies of different sizes, and two levels of responsibility, professionals and managers. The attributes of the present study's sample are appropriate to capture the impact of these variations in the magnitude of utilization.

Specification of the Dependent Variable "Use"

The conceptualization and operationalization of knowledge utilization is still under development. There is not yet a validated measure of utilization. Regarding measurement, studies in the field of knowledge utilization are based on two designs: the discrete event design, and the decision-making process design. In the former, respondents are asked to identify how the findings of a single study affect a discrete decision by the research users. The conceptualization and operationalization of utilization in terms of instrumental use transform utilization into events. According to Weiss (1980), instrumental use is rare and, when observed, tends to be more frequent in private than in public organizations (Caplan 1975; Dunn 1980). In the second design, respondents are asked to identify how the knowledge produced across all of the stages of the research process influences the spectrum of stages of users' decision-making processes (Lomas 1997; Landry, Amara, and Lamari 2001). Assuming that a discrete decision can be attributed to the use of a discrete research report is rather simplistic because research findings generate many effects, not a single effect (Mandell and Sauter 1984), and because decisions do not depend on a single piece of research, but on a series of research results converging toward one direction (Booth 1990; Lomas 1997; Rich 1997). The proposed study is based on a decision-making process design.

Over the years, many scales and indices have been designed to measure knowledge utilization. The most frequently cited are the Hall levels of use scale (Hall et al. 1975), the Hall stages of concern scale (Hall, George, and Rutherford 1979), the Johnson evaluation utilization scale (Johnson 1980), the Pelz and Horsley research utilization index (Pelz and Horsley 1981), the van de Vall and Bolas overall policy impact scale (van de Vall and Bolas 1982), and the Larsen information utilization scale (Larsen 1982). Although they represent attempts to conceptualize utilization in terms of processes, these scales still focus too much attention on instrumental use and on particular uses of research (that is, utilization of evaluation). Knott and Wildavsky (1980) offer one of the few scales to conceptualize utilization as a process rather than as a discrete event. They correctly suggest that knowledge use must be examined at various levels or stages: "Delimitation of a role for dissemination, therefore, requires keeping levels of utilization distinct. The various levels may usefully be conceived as stages in which each is a link in the chain of utilization. For an analysis of dissemination, it is not necessary to choose one particular level as the standard. Which standard is related to dissemination is an empirical question. It is important, however, to keep the levels distinct and to relate strategies of dissemination to a particular level of utilization" (545).

As Webber (1992) points out, the stages of the Knott and Wildavsky scale are "meant not only to capture the extent to which information is processed cognitively by the policy-makers but also its consequence in the policy process" (21). The Knott and Wildavsky scale is frequently cited in the literature on knowledge utilization. Furthermore, their scale has been used by Lester and Wilds (1990) and Lester (1993) to derive an index based on seven cumulative stages of utilization by state agency officials. Recently, Landry, Amara and Lamari (2001) have used the same scale with a large data set regarding the utilization of social sciences in Canada. Those authored perform an item analysis of the stages of this scale. They obtain an internal-reliability coefficient (Cronbach's alpha) of 0.89 for the index of utilization constructed with the stages derived from the Knott and Wildavsky scale of utilization. The scale used in this study includes six stages: reception, cognition, discussion, reference, effort, and influence. The scale

is cumulative in the sense that cognition builds on reception, discussion on cognition, reference on discussion, effort on reference, and influence on effort. Table 1 presents the descriptive stages of knowledge use, such as was presented in the questionnaire sent to the survey respondents. Although it is premature for the students of knowledge utilization to restrict themselves to a single measure of utilization as a dependent variable, we assume the cumulative advancement of scholarly knowledge in the field of knowledge utilization would be facilitated by several applications of the same specifications of use rather than single applications of different specifications of use in every study.

Table 1 Stages of Knowledge Utilization

Stage 1	Reception: I received the university research pertinent to my work.
Stage 2	Cognition: I read and understood the university research that I received.
Stage 3	Discussion: I participated in meetings for discussion and popularization of the aforementioned university research.
Stage 4	Reference: I cited university research studies as references in my own professional reports or documents.
Stage 5	Effort (adoption): I made efforts to favor the use of university research results.
Stage 6	Influence: University research results influenced decisions in my administrative unit.

Adapted from Knott and Wildawsky (1980).

Problems Associated with the Independent Variables

There is not yet a body of systematic empirical evidence regarding the particular factors that explain knowledge utilization in a statistically significant manner (Dunn, Holzner, and Zaltman 1985). In the absence of a dominant explanatory model, the independent variables proposed in the literature look more like checklists of variables assumed to explain utilization, rather than formal heuristic devices (Lester 1993). The pioneering studies in knowledge utilization pay most attention to variables relating to the characteristics of the research products (Caplan 1975; Knorr 1977; Anderson, Ciarlo, and Brodie 1981; Conner 1981; Larsen and Werner 1981; Pelz and Horsley 1981; Weiss 1981). In a second stage, a number of scholars began to stress the importance of policy contextual factors (Lee and Staffeldt 1977; Sabatier 1978; Webber 1984, 1987; Whiteman 1985; Lester and Wilds 1990; Lester 1993). Recently, another group of scholars has begun to stress the importance of other explanatory factors, such as dissemination and links and exchanges between researchers and the users of research (Huberman, and Thurler 1991; Huberman 1994, 1999; Lomas 1997, 2000; Landry, Amara, and Lamari 2001).

To facilitate the discussion and the cumulative growth of knowledge in the field of knowledge utilization, the categories of independent variables employed in conceptual and empirical studies should be derived from prior studies and then integrated in general conceptual frameworks that would become heuristic devices predicting what factors determine knowledge utilization. We think it is possible to integrate the independent variables cited in the literature within two major categories of explanations: engineering explanations, and socio-organizational explanations of knowledge utilization. In the engineering explanations, the opportunities to improve the services provided by government agencies are found in the uptake of research findings. In this category, university research is a source of new or improved services. The production and uptake of research follow a linear sequence from the research findings to the definition of a service and specifications of production, and the application of instrumental findings that conforms the specifications defined by research that has resulted into scientific publications. In this perspective, the production of a service by a government agency is a solution to an engineering problem. The science policy literature refers to this type of solution as the "science push" or the "technology push" solution. Prior studies have considered many dimensions of research findings influencing utilization: (1) content attributes of research, notably, efficiency, compatibility, complexity, observability, trialability, validity, reliability, divisibility, applicability, radicalness (Weiss and Bucuvalas 1980; Edwards 1991; Lomas 1993; Dearing, Meyer and Kazmierczak 1994); and (2) types of research: basic, theoretical/applied, general/abstract (Machlup 1980), quantitative/qualitative (Huberman and Thurler 1991), particular/concrete (Rich 1997), and research domains and disciplines (Oh 1997; Rich 1997; Landry, Amara, and Lamari 2001). With respect to content attributes, the engineering explanations hypothesize that knowledge use increases when researchers focus their projects on the advancement of scholarly knowledge. In the engineering explanations of knowledge utilization, use is explained by the advancements brought by the research products. The theoretical and quantitative studies are the flagships of knowledge advancements in the field of government agencies. Therefore, one may predict that theoretical and quantitative studies are more likely than qualitative studies to explain knowledge use. However, in a transaction-costs interpretation, à la Williamson (1975, 1985), one would assume that the greater the difficulties to reading and understanding the theoretical and quantitative research reports, the higher the costs incurred by the users and, consequently, the less likely the use of research. Therefore, the impact of the types of research products on utilization is indeterminate. The indeterminate character of the impact of this type of variable is supported by some

empirical studies that have found no relation between the technical quality of research results and utilization (Dunn 1983; Huberman 1987; Edwards 1991). Although the engineering explanations may predict the uptake of research for some cases of standardized public services, they assume the uptake of research is independent of the organizational and social contexts in which government services are produced.

In contrast to the engineering explanations, the organizational and social explanations stress organizational and social factors that may hamper or facilitate the uptake of research. The literature on knowledge utilization focuses on three such explanations: organizational-interests explanations, two-communities explanations, and interaction explanations. Organizational-interests explanations assume that organizational structures, the size of agencies, types of policy domains, positions (professionals or managers), and the needs of organizations induce professionals and managers to underutilize university research. With respect to organizational needs, organizational-interests explanations hypothesize that the knowledge use increases when researchers focus their projects on the needs of the users rather than on the advancement of scholarly knowledge (Frenk 1992; Orlandi 1996; Chelimsky 1997; Silverside 1997). Prior empirical studies regarding users' organizational contexts point to the following results: The use of knowledge increases as users consider research pertinent, as research coincides with their needs, as users' attitudes give credibility to research, and as results reach users at the right time (Huberman and Thurler 1991; Landry, Amara, and Lamari 2001). The predictions that can be made regarding the other variables are still indeterminate.

"Two-communities" explanations assume that a difference between the culture of professionals and managers in government agencies and the culture of university researchers leads to a lack of communication between them and, consequently, to low levels of knowledge utilization (Caplan 1979; Rich 1979; Webber 1987; Frenk 1992; Oh and Rich 1996). These explanations suggest that professionals and managers in government agencies are reluctant to use university research because they do not share the norms and values of the researchers: They prefer research focused on users' needs to research focused on the advancement of scholarly knowledge. Likewise, professionals and managers in government agencies do not use the language of the researchers: They prefer research findings in readable language to technical scientific papers (Weiss 1973; Caplan 1979; Dunn 1980; Webber 1987; Rich and Oh 1993). Specifically, these explanations predict knowledge utilization with the recourse to two determinants: the types of research results, and the dissemination effort. In many cases, the products of research never get widely disseminated, and thus they have little significant impact (MacLean 1996). Furthermore, the one-way flow of information and "traditional" dissemination approaches have not proven effective in encouraging the adoption and implementation of new research results. Scholarly journals are inconvenient because they neglect to adapt to content, calendar, form, and mode of diffusion to meet the particularity of the users (Oh and Rich 1996; Lomas 1997). The mere reception of knowledge by the potential user does not imply its "use." Huberman and Thurler (1991) develop valid and interesting indicators of adaptations of research products. Adaptation includes factors such as efforts to make reports more readable and easier to understand, efforts to make conclusions and recommendations more specific and more operational, efforts to focus on variables amenable to interventions by users, and efforts to make reports more appealing. When researchers invest resources to adapt their products to facilitate their appropriation, it increases the use of research. In terms of transaction-cost economics, it means that the higher the costs supported by researchers to adapt their products, the lower the costs supported by the users and, as a consequence, the higher the use of research. Acquisition efforts are made when users engage resources in the acquisition of research knowledge—more precisely, when they have meetings to discuss the subject and scope of research projects with researchers, to discuss results with researchers, and to acquire knowledge results from researchers. One may deduce that the more resources users engage in acquisition activities, the higher the research use.

The lack of interaction between researchers and their potential audiences has been identified as the main problem in underutilizing research findings (Huberman 1987; Leung 1992; Oh and Rich 1996; Lomas 1997). This diagnostic has given rise to the interaction explanations (Dunn 1980; Yin and Moore 1988; Huberman and Thurler 1991; Nyden and Wiewell 1992; Oh 1997; Landry, Amara, and Lamari 2001). It suggests that knowledge utilization depends on disorderly interactions between researchers and users, rather than on linear sequences beginning with the needs of researchers or the needs of users. The supporters of these explanations predict that the more sustained and intense the interaction between researchers and users, the more likely utilization will occur. Unlike prior explanations, this perspective suggests giving greater attention to the relationships between researchers and users at different stages of knowledge production, dissemination, and utilization. The interaction explanations integrate in a single model the explanatory factors identified in prior models. Therefore, this model explains utilization by the recourse to four categories of factors in a context where each category of factors is necessary but not sufficient to explain the utilization of university research. In addition to integrating all of the variables of the previous model, the in-

teraction model explains utilization with the recourse to a new variable: the linkage mechanisms. Huberman and Thurler (1991) have devised one of the most interesting sets of indicators of mechanisms linking researchers and users. The mechanisms considered include informal personal contacts, participation in committees, and the transmission of reports to nonacademic organizations. The more resources the users and researchers invest in these types of linkage mechanisms, the higher the use of research. These hypotheses are summarized in table 2.

Table 2 Predictions Regarding the Impact of the Independent Variables on Knowledge Utilization

Independent variables	Dependent variable (Knowledge utilization)
Engineering factors:	
• Quantitative studies	+
• Qualitative studies	?
• Theoretical studies	?
• Focus on advancement of scholarly knowledge	–
Organizational factors:	
• Focus on users' needs	+
• Users' context	+
• Work relevance use	+
• Policy relevance use	+
• Federal or provincial agencies	?
• Number of employees in agencies	+
Two communities' factors	
• Adaptation of products to users	+
• Acquisition efforts of users	+
Linkage mechanisms	
• Intensity of linkages with researchers	+
Individual attributes	
• Education: graduate studies	+
• Position: professionals/managers	?

Problems Resulting from the Failure to Appreciate Respondents' Inability to Report and Explain Their Behavior Accurately

This problem arises from the usual practice of asking respondents to remember the extent to which a particular research report led them to make a decision that would not have been made otherwise. This type of question raises two problems: First, to what extent is it possible to rely on respondents' memories of the contents of single research reports and single discrete decisions made a few years earlier? It is difficult to assess whether memory biases are present. Second, to what extent is it realistic to assume that a single discrete decision was influenced by a single research report and, if so, what is the meaning of the word "influence"? According to Weiss (1986), "Rarely does research supply an 'answer' that policy actors employ to solve a policy problem" (217). Furthermore, as indicated in the discussion about the specifications of the dependent variable use, more and more students of knowledge utilization suggest that knowledge utilization is not an event, but a process. The specification and measurement of utilization in terms of multiple stages instead of single events solve these two problems by asking respondents to describe current and recent behavior. To avoid these two problems, the present study employs the following descriptive question: "Concerning the use of university work, please indicate your experience in relation to the six following aspects. Drawing on your experience of the last five years, check a single box using the following scale," where 1 = never; 2 = rarely; 3 = sometimes; 4 = often; and 5 = always. The six stages of this scale are described in table 1.

Data

The data used in this study were collected using a mail survey during the winter of 1998. The respondents were professionals and managers in Canadian and provincial government agencies. The sample of respondents was drawn following a two-stage process: In the first stage, we used the Corpus Government Index (issue 4, 1997) to identify government services having keywords related to policy development, implementation, and evaluation. The following keywords were used: policy and research, policy analysts, program policy, policy development, policy and strategic direction, strategic policy branch, planning and policy, policy secretariat, program development and evaluation branch, projects and policy, resources management, planning services, social and fiscal policy, local government policy, public affairs, and communications. Two research assistants independently identified the pertinent government services using these keywords. Then, the two lists were compared by the principal investigator to produce the final list of services used in the study. This selection process generated a list of 2,400 government services with their corresponding phone numbers. This task was completed in December 1997. In the second stage, we used the phone numbers collected at the first stage to obtain the names, professional titles, and full addresses of 2,400 potential respondents. A private survey firm, Infras Inc. from Québec, accomplished the second stage with the following guidelines: (1) For each province and territory, randomly select a number of respondents corresponding to the demographic weight of the Canadian provinces and territories; (2) randomly select respondents with university degrees; (3) randomly select 25 percent of the eligible respondents with managerial positions and 75 percent with professional positions; (4) produce a list of 2,400 labels with the names, professional titles, and full addresses of each potential respondent.

The mailing packets were prepared during January 1998. The mailing packet sent to each respondent included a cover letter, a questionnaire of 23 questions, and a pre-addressed return envelope. The packets were mailed March 6, 1998. A follow-up letter was sent two weeks later. A total of 988 questionnaires were returned to us, resulting in a gross re-

turn rate of 41 percent. However, 105 questionnaires were unusable for the following reasons: questionnaires were returned to us with mentions of wrong address (65); potential respondents were on vacation or out of town for more than two weeks (12); respondents had health problems (1); and refusals to participate to the study (no time, not the best person to answer, the topic of the survey is not pertinent to my job, no reason provided) (27). Therefore, 833 questionnaires were usable, a net return rate of 35 percent. This return rate can be considered as quite good. Such a data set—composed of respondents holding positions at different hierarchical levels and involved in various policy domains and many different departments in Canadian and provincial government agencies—is especially appropriate to study the factors explaining the utilization of policy knowledge in federal and provincial government agencies.

Findings

The findings of the study are presented in three steps. We first present the general characteristics of the participants in the study. Then, we deal with the extent of use in general and the differences of use across policy domains. Finally, we consider variables affecting the utilization of research in government agencies.

Sample Characteristics: Descriptive Statistics

Of the 833 respondents who participated in the survey, 10 percent held a doctorate, 45 percent held a master's degree, 37 percent held a baccalaureate degree, and 6 percent held either a college degree or other degrees. The average age was 47.4 years, with a standard deviation of 7.1 years. On average, the respondents had 7.6 years of experience in their current position, with a standard deviation of 6.3 years. The average number of employees in the immediate administrative unit of the respondents was 66, with a standard deviation of 335 and a maximum of 7,000. As for the average number of employees in the ministry or governmental agency where the respondents worked, it is 2,900 with a standard deviation of 6,147. Slightly more than one-third of the respondents worked in the western provinces, 17 percent in the Maritimes, 26.4 percent in Ontario, and 21 percent in Québec. One-quarter of the respondents occupied positions in the Canadian government agencies, whereas the remaining three-quarters occupied positions in provincial government agencies. Finally, half of the respondents indicated they occupied managerial positions, 38 percent occupied professional positions, and the remaining 11 percent occupied other types of positions.

These respondents were involved in a large variety of policy domains. Of the 833 respondents, 13 percent worked in municipal and regional affairs, public works, and public infrastructures; 27 percent in economic development, public finance, and taxation; 9 percent in education, communication, and technology; 11 percent in environment, forestry, fishing, and agriculture; 18 percent in social services, health, and social security; 9 percent in language, culture, immigration, justice, and native affairs; 11 percent in job creation and employment conditions including labor relations; and 2 percent in other domains, such as leisure and intergovernmental affairs.

Extent and Differences of the Use of Research in Government Agencies

The results in table 3 indicate that nearly 12 percent of the professionals and managers in government agencies in the social sciences reported they usually or always receive university research pertinent to their work. At the other extreme, 16 percent of the respondents never receive university research pertinent to their work or believed this question does not apply to their work situation. One-third of the respondents reported they rarely receive university research pertinent to their work, whereas 40 percent indicated they sometimes receive university research pertinent to their professional activities. As one moves through the six stages from reception to influence, one can observe an increase in the university research that is rarely or never used and, conversely, a decrease in the university research that is usually or always used. Still, 8 percent of the respondents reported that the university research results they have received have usually influenced decisions in their administrative units and, slightly less than 1 percent indicated that the university research findings they have received have always influenced decisions in their administrative units. On the whole, this suggests that 53 percent of the university research results have never (including does not apply) or rarely influenced decisions in the administrative units of the respondents, whereas 9 percent of the university research findings received by the respondents have usually or always influenced decisions in their administrative units. These results suggest that a large proportion of professionals and managers in government agencies receive scholarly research that is pertinent to their work, and this research influences the decisions made in these milieus more frequently than is assumed. These results do not consider possible differences in utilization across policy domains; we will now consider this question in turning our attention to differences across policy domains.

To compare the level of knowledge utilization across policy domains, we use a one-way Anova—more specifically, the Duncan's multiple range test, which compares the means for groups in homogeneous subsets. This test is appropriate for grouping the different policy domains into homogeneous subsets—that is, policy domains between which the differences of means are not statistically significant—and hence to compare the means of the different

Table 3 Frequency Distribution by Stages of Knowledge Utilization

	Frequency of knowledge utilization							
	Does not apply and missing data	Never 1	Rarely 2	Sometimes 3	Usually 4	Always 5	Total	Average on 1 to 5 scale (S.D.)[a]
Stages of utilization	Frequency (percent)	Frequency (percent)	Frequency (percent)	Frequency (percent)	Frequency (percent)	Frequency (percent)	Frequency (percent)	
Reception	82 (9.9)	54 (6.5)	269 (32.3)	330 (39.6)	91 (10.9)	7 (.8)	833 (100)	2.38 (1.11)
Cognition	111 (13.3)	8 (1.0)	42 (5.0)	211 (25.3)	362 (43.5)	99 (11.9)	833 (100)	3.20 (1.47)
Discussion	118 (14.2)	234 (28.1)	261 (31.3)	178 (21.4)	40 (4.8)	2 (.2)	833 (100)	1.75 (1.10)
Reference	93 (11.2)	120 (14.4)	204 (24.5)	269 (32.3)	126 (15.1)	21 (2.5)	833 (100)	2.33 (1.28)
Adoption	101 (12.1)	136 (16.3)	244 (29.3)	243 (29.2)	103 (12.4)	833 (.7)	6 (100)	2.15 (1.21)
Influence	94 (11.4)	81 (9.7)	263 (31.6)	321 (38.5)	67 (8.0)	7 (.8)	833 (100)	2.25 (1.13)

[a] Standard deviation.

subsets. The null hypothesis tested is the equality of means for the variable knowledge utilization between the different policy domains. An index including the six stages of knowledge utilization was developed: reception, cognition, discussion, reference, effort, and influence. Each stage is presumed to be more important than the previous one, and the entire scale is cumulative in that all of the stages of knowledge use are important indicators and build on each other (Knott and Wildavsky 1980; Lester and Wilds 1990; Lester 1993; Landry, Amara and Lamari 2001). Cognition builds on reception, discussion on cognition, reference on discussion, effort on reference, and influence on effort. Therefore, each successive stage needs to be weighed more heavily as one moves from one stage to the next. The index was created on the following bases: The respondents were asked to indicate on a 0–5 scale (0 = does not apply, 1 = never, and 5= always) how accurately each stage described the utilization of their research for the last five years (see table 1 for the exact wording of the question describing the content of each stage). Each response was then multiplied by the scale score for each stage (by 1 for stage 1, by 2 for stage 2, and so on) to produce a summary score out of a possible scale of 105. Therefore, the means of utilization can range from 0 to 105.

The results of Duncan's test are reported in table 4. They indicate there are four homogeneous subsets of policy domains between which there are no significant statistical difference. The level of knowledge utilization, with a score of 41.03, is at its lowest in the policy domains of municipal and regional affairs, public works, and public infrastructures. With a score of 56.62, the utilization of university research reaches its highest level in the policy domains of education and information technology. The policy domains of social services, health, and social security score very well with a mean score of 54.06. As table 4 shows, there is no significant statistical difference between the following four groups of policy domains in matter of utilization of university research: job creation and employment standards; language, culture and immigration, and native affairs; economic development, public finance, and taxation; and environment, forestry, fishing, and agriculture. Overall, these results confirm that policy domains matter and that the professionals and managers involved in certain policy domains make greater use of university research than professionals and managers in other policy domains. How can one explain these differences in the magnitude of research utilization? We will now consider this question with regression models.

Regression Models

The utilization of university research by professionals and managers in government agencies is examined by using the explanatory variables introduced in table 2. The dependent variable refers to the different stages of utilization defined in the Knott–Wildavsky scale of knowledge utilization (1980). To study the impact of the explanatory variables on the quantitative dependent variable, we have developed the following ordinary least squares model:

$$KU = \beta_0 + \beta_1 QUANP + \beta_2 QUALP + \beta_3 THEOR +$$

Table 4 Means of Knowledge Utilization for Domains of Public Policies in Homogeneous Subsets (Duncan's Test)

		Subset for alpha = .05			
Domains	Number of observations	1	2	3	4
Municipal and regional affairs, public works and public infrastructures	110	41.03			
Job creation and employment standards	89	44.35	44.35		
Language, culture and immigration, justice and native affairs	73	44.63	44.63		
Economic development, finance, and fiscal laws	226	46.21	46.21		
Environment, forest, fishing, and agriculture	95		49.42	49.42	
Social services, health, and Social Security	148			54.06	54.06
Education and information technology	71				56.62
Significance[a]		.103	.111	.109	.377

[a] When the significance test is above the threshold alpha = .05, the null hypothesis cannot be rejected.

β_4 ADAPP + β_5 ACQUI + β_6 LINKA + β_7USERC + β_8KNOWF + β_9USERF + β_{10}WORREL + β_{11}POLREL + β_{12}DIPLOM + β_{13}FUNCT + β_{14}FEDPRO + β_{15}SIZE + e,

where, β_i (i= 0…….15) are coefficients.

This model is estimated for the policy domains altogether, and it is estimated by taking each of the seven policy domains included in the study separately, because we hypothesize that utilization is not necessarily explained by the same variables from one policy domain to the other.

The Measure of the Dependent Variable

Following Lester and Wilds (1990), Lester (1993), and Landry, Amara and Lamari (2001), the dependent variable of this study is an index derived from the Knott–Wildavsky scale (1980). This scale includes six cumulative stages of knowledge utilization: reception, cognition, discussion, reference, effort, and influence, generating a scale score of 0–105.

An item analysis on the components of this additive scale was performed by computing the Cronbach's alpha. This coefficient provides a reliability coefficient for multiple items scales, such as those included in the scale of knowledge utilization. The Cronbach's alpha for the dependent variable (.89) and all of the independent variables based on multiple-items scales is shown in the appendix. The values of the Cronbach's alpha coefficients reported in the appendix indicate that all the multiple-items scales used in this study are reliable.

The Measures of the Independent Variables

The independent variables included in the explanatory model are measured as follows:

QUANP: Research products based on data analyzed using correlation or multivariate techniques are used by respondents. (1 = correlation or multivariate techniques are usually or always used by respondents, 0 = otherwise).

QUALP: Research products based on case studies using qualitative data are used by respondents (1 = case studies based on qualitative data are usually or always used by respondents, 0 = otherwise).

THEOR: Respondents use research products taking the form of theoretical studies. (1= theoretical studies are usually or always used by respondents, 0=otherwise)

ADAPP: Adaptation of products measured as an index of importance given by the researcher in adapting his research products for users. This index is composed of nine cumulative dimensions, measured on a five-point scale of adaptation where 0 = does not apply, 1 = negligible adaptation, and 5 = decisive adaptation. The nine dimensions are (1) ease of comprehension of research reports; (2) the specific, operational nature of conclusions or recommendations; (3) a focus on variables for which user intervention is possible; (4) the credibility and prestige of the source; (5) the pertinence and applicability of information in relation to the objectives that I pursue in my work; (6) the realism of both recommendations contained in the research and their implications; (7) the capacity to verify the quality of research results; (8) the capacity to control exclusivity of research results use; (9) the appeal of reports (graphics, color, humor, packaging). Therefore, the index ranges from 0 to 45.

ACQUI: Acquisition effort, measured by an index of importance accorded by the respondents to two types of acquisition efforts during the last five years. The scale of importance of these activities ranges from 0 to 5, where 0 = does not apply, 1 = negligible importance, and 5 = decisive importance. The two items included are (1) I personally made efforts to establish relationships with university researchers; and (2) my administrative unit reserves sufficient means to obtain information resulting from university research work. This index ranges from 0 to 10.

LINKA: The intensity of links of users with researchers is measured as an index indicating the importance given by the users to different means to obtain information from university research carried out in their field over the last five years. The scale of importance of the mechanisms ranges from 0 to 5, where 0 = does not apply, 1 = negligible importance, and 5 = decisive importance. The four linkage mechanisms considered are (1) meetings with work colleagues in my field; (2) congresses, conferences, scientific seminars involving university researchers; (3) electronic mail and the Internet; (4) my ministry's reference library. Therefore, this index ranges from 0 to 20.

USERC: Assessment of the context in which respondents use university research, measured as an index indicating the assessment of the respondents regarding three statements. The assessment is measured on a scale ranging from 0 to 5, where 0 = does not apply, 1 = never, and 5 = always. The three statements considered are (1) university research results are considered pertinent by my workplace colleagues; (2) my colleagues' research work, studies, and reports are more useful to me than the research works, studies, and reports produced by university researchers; (3) university research work, studies, and reports have reached me at just the right moment to be used. Therefore, this index ranges from 0 to 15.

KNOWF: Assessment of respondents regarding the extent to which university research in their field of work is focussed on the advancement of scholarly knowledge (1 = university research is always or often focused on the advancement of scholarly knowledge, 0 = otherwise).

USERF: Assessment of respondents regarding the extent to which university research is focussed on users' needs in their field of work (1 = university research is always or often focused on users' needs, 0 = otherwise).

WORREL: Assessment of respondents regarding the frequency at which they use university research information, studies, and reports to understand the working of programs and policies implemented in their field (1 = always, often, or sometimes uses university research to understand the working of programs and policies implemented in their field, 0 = otherwise).

POLREL: Assessment of respondents regarding the degree of importance they give to university research information, studies, and reports to improve programs and policies in their field (1 = always, often or sometimes uses university research to improve programs and policies in effect in their field, 0 = otherwise).

DIPLOM: Education of respondents (1 = master's degree or doctorate, 0 = otherwise).

FUNCT: Type of position occupied by respondents (1 = professionals, 0 = managers).

FEDPRO: Federal or provincial administration (1 = respondents work in a federal agency, 0 = provincial).

SIZE: Number of employees in respondents' government agencies.

Results

Regression results are summarized in table 5. It can be seen that, in the comprehensive model that includes respondents from all policy domains, quantitative reports, qualitative reports, adaptation of research results, acquisition efforts, linkage mechanisms, users' context, focus on advancement of scholarly knowledge, relevance of university research for the field of work of the respondents, importance of university research in the field of the respondents, education, and level of administration are significantly related to the utilization of university research. All of these explanatory variables are positively related to the uptake of university research, except the variable concerning the level of government agency, where the negative sign indicates that respondents in federal government agencies are less likely to use university research than respondents in provincial government agencies. The four other variables included in the model—theoretical reports, focus of research, the level of responsibility, and the number of employees in the agency—were not related to the utilization of university research. The total variance in the magnitude of utilization of university research explained by this model is shown by the adjusted R^2 to be .68. In a second step, we have used the same explanatory variables to show that the same variables do not account equally for knowledge utilization in all policy domains.

The next seven columns of table 5 report the regression results for each of the categories of policy domains considered in the study. Let us first consider the capacity of the different variables to explain utilization in the different policy domains. Acquisition efforts made by users of university research explain utilization in all policy domains. Three variables explain utilization in six of the seven policy domains: intensity of links between users and researchers explain utilization in all policy domains except job creation and employment standards; the user's context explains the uptake of university research in all policy domains except education and information technology; and respondents' assessment of the frequency to which they use university research to understand the working of programs and policies implemented in their field also explains utilization in all policy domains except education and information technology. The adaptation of research products for users explains the uptake of university research in all policy domains except job creation and employment standards and social services, health, and social security. Having a master's degree or a doctorate explains the uptake of university research in three policy domains: municipal affairs, public works, and public infrastructures; social services, health, and social security; and language, culture and immigration, justice, and native affairs. Working in a federal government agency decreases the uptake of university research in municipal and regional affairs, public works, and public infrastructures and in economic development, public finance, and fiscal matters; however, respondents in federal government agencies are more likely than their provincial counterparts to use university research when they are involved in education and information technology. The characteristics of the research products measured in terms of quantitative, qualitative, and theoretical reports explain the uptake of university research in only two policy domains. The focus of research on users' needs explains the utilization of research only in the domain of education and information technology. The importance that respondents accord to university research to improve programs and policies in their field explains utilization only in the domain of economic development, public finance and fiscal matters. As for the size of government agencies, it explains the uptake of university research only in education and information technology, and its impact is negative, indicating that a higher number of employees decreases the uptake of university research. Finally, the focus of university research on the advancement of scholarly knowledge in the respondent's field does not explain the use of university research in any single policy domain.

Let us now turn our attention from the variables to the policy domains. The results of the Duncan's test (table 4) indicate the policy domains can be grouped into four levels of use. The domains of education and information technology and social services, health, and social security ranked highest on the scale of knowledge utilization. As table 5 shows, the adaptation of research products, the acquisition efforts, the intensity of the linkages, the focus of

research on users' needs, working for a federal agency, and working in a small agency are significantly related to the use of research in the domain of education and information technology. The nine other explanatory factors are not significantly associated to utilization in education and information technology. The total variance in knowledge utilization explained in this policy domain is shown by the adjusted R^2 to be 0.56. As for social services, health, and social security, which also ranked in the highest group of users of university research, table 5 shows that the variables for quantitative reports, qualitative reports, acquisition efforts, linkage mechanisms, users' context, work relevance, and having a graduate degree are significantly and positively related to utilization. The eight other variables do not explain the utilization of research in this policy domain. The total variance in utilization explained in social services, health, and social security is shown by the adjusted R^2 to be 0.67. As table 4 indicates, four policy domains ranked lowest on the scale of knowledge utilization. The uptake of research in these domains is explained by six to nine variables, and the total variance explained for these policy domains ranges from 0.47 to 0.75. The attributes of the research products (quantitative reports, qualitative reports, and theoretical reports) and the focus of uni-

Table 5 Regression Equations Predicting Utilization of Social Science Knowledge

Political domain	All domains	Domain (1)	Domain (2)	Domain (3)	Domain (4)	Domain (5)	Domain (6)	Domain (7)
Independent variables								
Intercept	−1.604 (−1.06)	−2.622 (−.82)	.220 (.07)	.130 (.01)	−6.049 (−1.30)*	−.234 (−.05)	−3.796 (−.85)	2.771 (.35)
Engineering factors								
Quantitative products (QUANP)	2.703 (2.86)***	5.583 (1.79)**	1.772 (.93)	−1.745 (−.49)	2.599 (1.12)	3.573 (1.53)*	2.538 (.71)	2.748 (.66)
Qualitative products (QUALP)	2.168 (2.12)**	−2.670 (−.88)	1.440 (.63)	1.729 (.439)	1.304 (.52)	4.075 (1.58)*	.006 (.02)	5.319 (1.51)*
Theoretical products (THEOR)	−.298 (−.26)	4.594 (1.54)*	−.983 (−.45)	1.764 (.38)	−4.840 (−1.75)**	1.383 (.45)	1.394 (.22)	1.493 (.37)
Focus on advancement of scholarly knowledge (KNOWF)	1.255 (1.39)*	−.966 (−.393)	1.749 (.95)	−1.994 (−.59)	1.980 (.85)	1.081 (.43)	−1.110 (−.27)	.491 (.147)
Organizational factors								
Focus on users' needs (USERF)	1.221 (1.17)	−3.863 (−1.25)	2.859 (1.27)	10.066 (2.54)***	.318 (.12)	.808 (.33)	−3.578 (−.88)	−.610 (−.158)
Users' context (USERC)	1.068 (5.19)***	1.322 (2.39)***	1.036 (2.33)**	−.253 (−.25)	1.053 (2.47)***	.995 (1.49)*	1.317 (1.79)**	1.844 (1.93)**
Work relevance (WORREL)	5.611 (5.29)***	7.428 (2.50)***	6.356 (3.02)***	5.983 (1.26)	3.717 (1.43)*	4.574 (1.46)*	6.427 (1.55)*	4.980 (1.47)*
Policy relevance (POLREL)	3.170 (2.99)***	1.750 (.62)	4.203 (1.99)**	1.914 (.40)	−1.406 (−.56)	6.672 (2.18)	.618 (.15)	2.155 (.61)
Federal or provincial administration (FEDPRO)	−1.94 (−2.04)**	−4.625 (−1.84)**	−2.867 (−1.57)*	14.609 (1.83)**	−.653 (−.27)	.405 (.15)	−.274 (−.07)	2.776 (.74)
Number of employees (SIZE)	.001 (.06)	.029 (.57)	.021 (.85)	−.293 (−2.85)***	.017 (.2)	.002 (.09)	−.032 (−.27)	−.027 (−.48)
Two communities' factors								
Adaptation of products (ADAPP)	.311 (5.32)***	.341 (2.59)***	.171 (1.32)*	.747 (2.88)***	.501 (3.04)***	.181 (1.15)	.552 (2.72)***	−.104 (−.37)
Acquisition efforts (ACQUI)	2.678 (10.49)***	2.675 (3.73)***	2.929 (5.49)***	3.597 (3.64)***	2.670 (4.11)***	2.898 (4.29)***	2.240 (2.47)***	3.016 (3.03)***
Linkage mechanisms								
Linkage mechanisms (LINKA)	1.030 (7.11)***	.731 (1.99)**	1.129 (4.02))***	.831 (1.30)*	1.321 (3.38)***	1.015 (2.51)***	.841 (1.55)*	.723 (1.19)
Individual attributes								
Graduate studies (DIPLOM)	3.656 (4.15)***	7.189 (3.07)***	2.090 (1.16)	3.470 (.84)	1.498 (.66)	4.467 (2.01)**	4.520 (1.39)*	2.047 (.60)
Function (FUNCT)	.571 (.66)	2.176 (.98)	−.543 (−.29)	−1.448 (−.45)	.617 (.29)	2.326 (.91)	3.449 (1.15)	.587 (.17)
N	824	108	224	70	94	145	72	87
Adjusted R^2	.688	.753	.677	.564	.702	.672	.716	.478
F	122.33***	22.96***	32.24***	7.05***	15.76***	20.81***	13.08***	6.30***

Figures in parentheses indicate T ratios.
* variable is significant at 10 percent level
** variable is significant at 5 percent level
*** variable is significant at 1 percent level

(1) = Municipal and regional affairs, public works, and public infrastructures; (2) = Economic development, finance, and fiscal matters; (3) = Education and information technology; (4) = Environment, forest, fishing, and agriculture; (5) = Social services, health, and Social Security; (6) = Language, culture and immigration, justice, and native affairs; (7) = Job creation and employment standards.

versity research either on the advancement of knowledge or on the users' needs do not tend to explain the lower magnitudes of use of university research in these domains.

Discussion and Policy Implications

This article has dealt with three questions: To what extent is university research used in government agencies? Are there differences between the policy domains in regard to the extent of use? What determines the use of university research in government agencies? To answer these questions while contributing to the advancement of scholarly knowledge in the field of knowledge utilization, we have indicated how this study tackles four major conceptual and methodological pitfalls that have affected many studies on the use of research. These four pitfalls are the composition of the study population; the specification of the dependent variable "use"; problems associated with the independent variables considered; and problems resulting the failure to appreciate respondents' inability to report and explain their behavior accurately. To represent the most important sources of variation in the magnitude of the use of research, the sample used in this study is large (n = 833) and includes diverse categories of government agencies and diverse categories of employees (professionals and managers) involved in diverse policy domains (n = 7). Instead of conceptualizing and measuring the dependent variable "use" in terms of instrumental use, this study conceptualizes and measures use in terms of stages that are a part of decision-making processes, thus assuming that knowledge use can be examined at various levels or stages. In the absence of a dominant explanatory model, the independent variables proposed in empirical studies tend to look like checklists of variables that are assumed to explain utilization. To facilitate the discussion and the cumulative growth of knowledge in the field of knowledge utilization, the present study derives its independent variables from prior conceptual and empirical studies, and it integrates them in a general conceptual model, making room for four blocks of variables borrowed from the engineering model, the organizational-interests model, the two-communities model, and the interaction model. Finally, to avoid problems of unwarranted reliance on respondents' introspection that are present in studies based on instrumental measures of use, this study asked the respondents to describe their current practices regarding different stages of research uptake.

Based on the answers of 833 professionals and managers in Canadian federal and provincial government agencies, our findings show that nearly 12 percent of the respondents usually or always reach the first stage of utilization—that is, reception of research—whereas 16 percent of the respondents do not even get through this first stage. These simple descriptive findings suggest that university research is used more extensively than is commonly assumed. Furthermore, comparisons of the means of utilization among various policy domains show the means of knowledge utilization range from 41.3 for municipal and regional affairs, public works, and public infrastructures to 56.6 for education and information technology. Duncan's test shows there are four homogeneous subsets of policy domains. These results confirm that policy domains matter and that professionals and managers involved in certain policy domains make higher use of university research than others. How can one explain these differences in the magnitude of research utilization? This question was considered with regression models.

The results of the regression models show the determinants of knowledge utilization included in the engineering model regarding the characteristics of the research products are not good predictors of knowledge utilization in government agencies. Furthermore, the findings also show the focus of research on the advancement of scholarly knowledge does not significantly explain the uptake of research in any single policy domain. As for the variables derived from the organizational-interests models, their predictive capacity is mixed: The best predictor derived from this model is the user's context, while the worst predictors are the focus of research on users' needs and the size of the government agencies. The variables derived from the two-communities model and from the interaction model—adaptation of research products to users, users' acquisition efforts, and the intensity of the links between users and researchers—are very good predictors of the uptake of university research. Finally, the two individual attributes included in the regression models have delivered mixed results: The respondent's level of responsibility never explains significantly utilization, whereas the level of education explains the uptake of research in three of seven policy domains considered in this study. Clearly, this article shows the determinants associated with the engineering model are the worst predictors of the uptake of university research in government agencies.

Let us now turn to the implications of the findings for each category of variables. The types of research products (quantitative studies, qualitative studies, and theoretical studies) employed to produce research findings have been shown to be much less important than predicted by the engineering model. Likewise, the focus of university research on the advancement of scholarly knowledge explains the uptake of research in government agencies in the aggregate model, but it fails to do so at the policy-domain level. On the whole, these results suggest the types of research products and the focus on the advancement of scholarly knowledge are neither good predictors of the uptake of university research nor good levers of intervention. As a

consequence, policy makers should avoid using these factors as levers of intervention because they exert no impact on the uptake of research in government agencies.

As for the variables derived from the organizational-interests model, the variable "user's context" positively influenced utilization in all but one policy domain. This result carries important theoretical and practical implications. Factors regarding the user's context are contingent on the users' particular situations and, as a consequence, are difficult to include in a deductive theory of knowledge utilization. Furthermore, the fact that many of the factors included in the user's context are neither under the control of the researchers nor under the control of the policy makers implies the margins for intervention are thin. One course of action that might be considered to improve context consists of investing resources in actions that would make the users' context more receptive to university research. We suggest that it could be achieved at low cost by symbolic interventions stressing the pertinence and validity of university research in the particular field of work of the different government agencies.

Furthermore, in examining the focus of the research projects, we were astonished to find that research projects focused on users' needs were not more likely to lend to utilization than projects focused on the advancement of scholarly knowledge. Focus on users' needs positively influences utilization only in the policy domain of education and information technology. The fact that the focus of the projects, either on users' needs or on the advancement of scholarly knowledge, did not explain utilization in most of the policy domains implies this factor does not affect utilization. Therefore, policy interventions should not attempt to influence focus in attempting to induce the researchers to shift the focus of their projects from the advancement of scholarly knowledge to the users' needs.

The variables derived from the two-communities model are good predictors of the uptake of university research. Adaptation of research products for users positively influences use in all but two policy domains. Acquisition efforts explain the uptake of university research in all the policy domains considered in this study. Clearly, adaptation of research products and acquisition efforts positively influence utilization. As a consequence, increasing the adaptation of research products and acquisition efforts may increase utilization. Acquisition efforts and adaptation are factors that are under the control of either researchers or decision makers. Knowledge utilization could be increased by creating incentives targeting these two factors.

The mechanisms linking researchers and users have been shown to be good predictors of knowledge utilization in all but one policy domain. Clearly, paying more attention to the linkage mechanisms could increase the uptake of university research in government agencies.

Overall, our most important finding is that the uptake of university research depends neither on the characteristics of the research products nor on the focus of research on the advancement of scholarly knowledge or the users' needs; rather, it depends on users' acquisition efforts, scholars' adaptation of research products, the intensity of the links between scholars and users, and on users' organizational contextual factors.

This study has shown that utilization of university research in government agencies is far more complex than is predicted by the existing theories, and it is influenced by contingent factors that will be difficult to integrate into a comprehensive theory of knowledge utilization. Therefore, additional theoretical research is needed to refine the existing theories of knowledge utilization and, likewise, more empirical studies are needed to better identify the factors explaining the uptake of university research in diverse categories of government agencies and policy domains.

Acknowledgment

The authors thank the Social Sciences and Humanities Research Council of Canada for its financial support.

References

Anderson, Cathy, James A. Ciarlo, and Susan Brodie. 1981. Measuring Evaluation-Induced Change in Mental Health Programs. In *Utilizing Evaluation. Concepts and Measurement Techniques*, edited by James A. Ciarlo, 97–124. Beverly Hills, CA: Sage Publications.

Beyer, Janice, and Harrison Trice. 1982. The Utilization Process. A Conceptual Framework and Synthesis of Empirical Findings. *Administrative Science Quarterly* 27(4): 591–622.

Booth, Tim. 1990. Researching Policy Research. *Knowledge: Creation, Diffusion, Utilization* 12(1): 80–100.

Bozeman, Barry. 1986. The Credibility of Policy Analysis: Between Method and Use. *Policy Studies Journal* 14(4): 519–39.

Caplan, Nathan. 1975. The Use of Social Science Information by Federal Executives. In *Social Science and Public Policies*, edited by Gene M. Lyons, 47–67. Hanover, NH: Dartmouth College, Public Affairs Center.

———. 1979. The Two Communities Theory and Knowledge Utilization. *American Behavioral Scientist* 22(3): 459–70.

Chelimsky, Eleanor. 1997. The Coming Transformation in Evaluation. In *Evaluation for the 21st Century*, edited by Eleanor Chelimsky and William R. Shadish, 1–27. Thousand Oaks, CA: Sage Publications.

Conner, Ross. 1981. Measuring Evaluation Utilization: A Critique of Different Techniques. In *Utilizing Evaluation. Concepts and Measurement Techniques*, edited by James A. Ciarlo, 59–76. Beverly Hills, CA: Sage Publications.

Dearing, James, Gary Meyer, and Jeff Kazmierczak. 1994. Portraying the New: Communication between University Innovators and Potential Users. *Science Communication* 16(1): 11–42.

Dunn, William. 1980. The Two Communities Metaphor and Models of Knowledge Use. *Knowledge: Creation, Diffusion, Utilization* 1(4): 515–36.

———. 1983. Measuring Knowledge Use. *Knowledge: Creation, Diffusion, Utilization* 5(1): 120–33.

Dunn, William, Burkart Holzner, and Gerald Zaltman. 1985. Knowledge Utilization. In *International Encyclopedia of Education*, edited by Torsten Husén and Neville T. Postlewaite, 2831–39. Oxford, UK: Pergamon.

Edwards, Laura. 1991. *Using Knowledge and Technology to Improve the Quality of Life of People Who Have Disabilities: A Prosumer Approach*. Philadelphia, PA: Pennsylvania College of Optometry.

Frenk, J. 1992. Balancing Relevance and Excellence: Organizational Response to Link Research with Decision Making. *Social Science Medicine* 35(11): 1397–1404.

Hall, Gene, Archie George, and William Rutherford. 1979. *Measuring Stages of Concern About the Innovation: A Manual for Use of the SoC Questionnaire*. Austin, TX: Research and Development Center for Teacher Education, University of Texas.

Hall, Gene, Susan Loucks, William Rutherford, and Beulah Newlove. 1975. Levels of Use of the Innovation: A Framework for Analyzing Innovation Adoption. *Journal of Teacher Education* 26(1): 52–56.

Huberman, Michael. 1987. *Steps Toward an Integrated Model of Research Utilization, Knowledge*. Bern, Switzerland: Peter Lang SA, Éditions scientifiques européennes.

———. 1994. Research Utilization: The State of Art. *Knowledge and Policy* 7(4): 13–33.

———. 1999. The Mind Is Its Own Place: The Influence of Sustained Interactivity with Practitioners on Educational Researchers. *Harvard Educational Review* 69(3): 289–319.

Huberman, Michael, and Gather Thurler. 1991. *De la recherche à la pratique*. (From research to practice). Bern, Switzerland: Peter Lang SA, Éditions scientifiques européennes.

Johnson, Knowlton. 1980. Stimulating Evaluation by Integrating Academia and Practice. *Knowledge*: *Creation, Diffusion, Utilization* 2(2): 237–62.

Knorr, Karen. 1977. Policymakers' Use of Social Science Knowledge: Symbolic or Instrumental? In *Using Social Research in Public Policy Making*, edited by C.H. Weiss, 165–82. Lexington, MA: Lexington Books.

Knott, Jack, and Aaron Wildavsky. 1980. If Dissemination Is the Solution, What Is the Problem? *Knowledge: Creation, Diffusion, Utilization* 1(4): 537–78.

Landry, Réjean, Nabil Amara, and Moktar Lamari. 2001. Utilization of Social Science Research Knowledge in Canada. *Research Policy* 30(2): 333–49.

Larsen, Judith. 1982. *Information Utilization and Non-Utilization*. Palo Alto, CA: American Institutes for Research in the Behavioral Sciences.

Larsen, Judith, and Paul Werner. 1981. Measuring Utilization of Mental Health Program Consultation. *Utilizing Evaluation. Concepts and Measurement Techniques*, edited by James A. Ciarlo, 77–96. Beverly Hills, CA: Sage Publications.

Lee, Robert, and Raymond Staffeldt. 1977. Executive and Legislative Use of Policy Analysis in the State Budgetary Process: Survey Results. *Policy Analysis* 3(3): 395–406.

Lester, James. 1993. The Utilization of Policy Analysis by State Agency Officials. *Knowledge: Creation, Diffusion, Utilization* 14(3): 267–90.

Lester, James, and Leah Wilds. 1990. The Utilization of Public Policy Analysis: A Conceptual Framework. *Evaluation and Program Planning* 13(3): 313–19.

Leung, Paul. 1992. Translation of Knowledge into Practice. In *NIDRR National CRP Panel Final Report*, edited by Walcott and Associates, 287–306. Washington, DC: Walcott and Associates.

Lomas, Jonathan. 1993. Diffusion, Dissemination, and Implementation: Who Should Do What? In *Doing More Good than Harm: The Evaluation of Health Care Intervention*, edited by Kenneth S. Warren and Frederick Mosteller, 226–37. New York: New York Academy of Science.

———. 1997. Research and Evidence-Based Decision Making. *Australian and New Zealand Journal of Public Health* 21(5): 439–41.

———. 2000. Using "Linkage and Exchange" to Move Research into Policy at a Canadian Foundation. *Health Affairs* 19(3): 236–40.

Machlup, Fritz. 1980. *Knowledge and Knowledge Production*. Vol. 1. Princeton, NJ: Princeton University Press.

MacLean, David. 1996. Positioning Dissemination in Public Health Policy. *Canadian Journal of Public Health* 87(2): 40–43.

Mandell, Marvin, and Vicki Sauter. 1984. Approaches to the Study of Information Utilization in Public Agencies. *Knowledge: Creation, Diffusion, Utilization* 6(2): 145–63.

Nyden, Philip, and William Wiewell. 1992. Collaborative Research: Harnessing the Tensions between Researchers and Practitioners. *The American Sociologist* 23(1): 43–55.

Oh, Cheol. 1997. Issues for New Thinking of Knowledge Utilization: Introductory Remarks, Knowledge and Policy. *International Journal of Knowledge Transfer and Utilization* 10(3): 3–10.

———. 2000. *Science and Politics. A View from an Information Utilization Perspective*. Paper presented at the International Political Science Association World Congress, July 29–August 1, Québec City, Canada.

Oh, Cheol, and Robert Rich. 1996. Explaining Use of Information in Public Policymaking. *Knowledge and Policy* 9(1): 3–35.

Orlandi, Mario. 1996. Health Promotion Technology Transfer: Organizational Perspectives. *Canadian Journal of Public Health* 87(2): 28–33.

Pelz, Donald, and Jo Anne Horsley. 1981. Measuring Utilization of Nursing Research. In *Utilizing Evaluation. Concepts and Measurement Techniques*, edited by James A. Ciarlo, 125–49. Beverly Hills, CA: Sage Publications.

Rich, Robert. 1979. The Pursuit of Knowledge. *Knowledge: Creation, Diffusion, Utilization* 1(1): 6–30.

———. 1997. Measuring Knowledge Utilization Process and Outcomes, Knowledge and Policy. *International Journal of Knowledge Transfer and Utilization* 10(3): 3–10.

Rich, Robert, and Cheol Oh. 1993. The Utilization of Policy Research. In *Encyclopedia of Policy Studies*, edited by S. Nagel, 93–111. New York: Marcel Dekker.

Sabatier, Paul. 1978. The Acquisition and Utilization of Technical Information by Administrative Agencies. *Administrative Science Quarterly* 23(3): 396–417.

Silverside, Ann. 1997. Dissemination of Research Results to Clinicians an Art in Itself. *Canadian Medical Association Journal* 156(12): 1746–47.

Van de Vall, Mark, and Cheryl Bolas. 1982. Using Social Policy Research for Reducing Social Problems: An Empirical Analysis of Structure and Function. *Journal of Applied Behavioral Science* 18(1): 49–67.

Webber, David. 1984. Political Conditions Motivating Legislators' Use of Policy Information. *Policy Studies Review* 4(1): 110–18.

———. 1987. Legislators' Use of Policy Information. *American Behavioral Scientist* 30(6): 612–31.

———. 1992. The Distribution and Use of Policy Knowledge in the Policy Process. *Knowledge and Policy* 4(4): 6–35.

Weiss, Carol. 1973. The Politics of Impact Measurement. *Policy Studies Journal* 1(3): 179–83.

———. 1980. Knowledge Creep and Decision Accretion. *Knowledge: Creation, Diffusion, Utilization* 1(3): 381–404.

———. 1981. Measuring the Use of Evaluation. In *Utilizing Evaluation. Concepts and Measuring Techniques*, edited by James A. Ciarlo, 17–33. Beverly Hills, CA: Sage Publications.

———. 1986. Research and Policy-Making. A Limited Partnership. In *The Use and Abuse of Social Science*, edited by F. Keller, 214–35. London: Sage Publications.

Weiss, Carol, and M.J. Bucuvalas. 1980. Truth Tests and Utility Tests: Decision-Makers' Frames of References for Social Science Research. *American Sociological Review* 45(2): 302–13.

Whiteman, David Paul. 1985. The Fate of Policy Analysis in Congressional Decision Making: Three Types of Use in Committees. *Western Political Quarterly* 38(2): 294–311.

Williamson, Oliver. 1975. *Markets and Hierarchies*. New York: Free Press.

———. 1985. *The Economic Institutions of Capitalism*. New York: Free Press.

Yin, Robert, and G.B. Moore. 1988. Lessons on the Utilization of Research From Nine Case Experiences in the Natural Hazards Field, Knowledge in Society. *International Journal of Knowledge Transfer and Utilization* 1(3): 25–44.

Appendix Internal Reliability Coefficients (Cronbach's alpha) for Variables Including Multiple-Item Scales

Variables names	Number of cases	Number of items in scales	∝
Knowledge utilization (KU)	833	6	.89
Adaptation of products (ADAPP)	833	9	.91
Acquisition efforts (ACQUI)	833	2	.64
Linkage mechanisms (LINKA)	833	5	.67
Users' context (USERC)	833	3	.63