

UNPACKING STICKINESS: AN EMPIRICAL INVESTIGATION OF THE BARRIERS TO TRANSFER BEST PRACTICE INSIDE THE FIRM

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ABSTRACT

Stickiness, i.e. the difficulty to transfer knowledge, is emerging as a central construct for both scholars and practitioners interested in innovation. This paper reports the findings of a systematic empirical investigation into the origins of stickiness in a singularly balanced empirical setting: the barriers to transfer best practice inside the firm.

INTRODUCTION

Stickiness, i.e. the difficulty to transfer knowledge, is emerging as a central construct for both scholars and practitioners interested in innovation. Stickiness is seen as an important determinant of the locus of innovation related problem solving activity, of the degree of diffusion and utilization of superior knowledge and more broadly of the ability of a firm to grow and prosper by replicating existing assets and capabilities. Yet, the many possible determinants of stickiness have received remarkably little attention. Whereas the existence of multiple sources of stickiness is generally recognized, so far, the central tendency has been to minimize the importance of stickiness (e.g. Arrow, 1962) or to concentrate on its consequences regardless of origin (e.g. von Hippel, 1994).

This paper reports the findings of a systematic empirical investigation into the origins of stickiness aimed to address this gap in a setting which, of late, is reclaiming considerable managerial attention: the barriers to transfer best practice inside the firm¹. The transfer of best practice inside the firm offers a singularly balanced empirical setting to unpack stickiness. Unlike vertical transfers of knowledge which tend to occur between dissimilar units, e.g. between the R&D lab and the factory floor, and where the knowledge transferred is typically put to use for the first time by the recipient of knowledge, the transfer of best practice inside the firm involves mostly horizontal transfers of knowledge *already in use*. In this kind of transfers, the characteristics of the knowledge transferred or the communication gap that might exist between the source and the recipient of knowledge, salient in vertical transfers of knowledge, are more likely to partake prominence with characteristics of the source, the recipient or the context in which the transfer occurs. This makes the transfer of best practice inside the firm a more balanced empirical setting to study the components of stickiness.

In line with most studies of knowledge transfer, the inquiry reported in this paper is based on a communications metaphor (Shannon and Weaver, 1949). The problem of stickiness is analyzed by extending systematically a communications based logic pioneered by Arrow (1971) with pertinent insights from

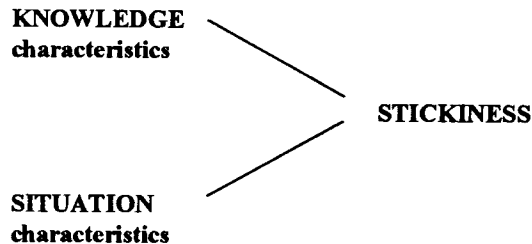
¹ By practice it is meant routine use of knowledge. A "best practice" is an important practice within the purview of the organization for which there exist reasonable proof of superiority both with respect to other internal alternate practices and with respect to known alternatives outside the company.

related fields – such as innovation diffusion, empirical sociology and organizational learning. Predictions from the resulting framework are formalized in nine propositions and tested through a two step large sample survey.

UNPACKING STICKINESS

When analyzed using a communications metaphor, the transfer of knowledge is likened to the transmission of a message from a source to a recipient in a given media. It is proposed that a sticky transfer is eventful. The eventfulness of a transfer is inferred from its outcome. Stickiness is seen to originate in characteristics of the knowledge transferred and in characteristics of the situation (see Figure 1).

FIGURE 1
Research Framework



Accordingly, origins of stickiness are classified as intrinsic to the knowledge transferred or as pertaining to the situation in which the knowledge is transferred. Two characteristics of the knowledge transferred – causal ambiguity and unprovenness – and seven characteristics of the situation – a source that lacks motivation or is not perceived as reliable, a recipient that lacks motivation, absorptive capacity or recipient capacity, a barren organizational context and an arduous relationship between source and recipient – are posited to contribute to stickiness.

Stickiness: Inferring Difficulty From the Outcome of Knowledge Transfer

A transfer is defined as sticky when it is worthy of remark, i.e. when it is an event. A transfer of knowledge will be less likely to escape being noticed the more costly it is (von Hippel, 1994) the longer it takes (Glaser, Abelson and Garrison, 1983; Rogers, 1983; Attewell, 1992) and the wider the gap between expectations and realizations (Pinto and Mantel, 1990). Accordingly, a transfer is not sticky when it is a non-event, i.e. costless, instantaneous and successful.

This definition of stickiness is consistent with the neoclassical treatment of knowledge as a public good transferable at zero marginal cost (cf. Arrow, 1962:614-615). If a transfer or replication of knowledge is costless, success can be taken for granted because the transfer or replication can be repeated costlessly until it succeeds. Thus the transfer of public knowledge is always a non-event.

However, this definition of stickiness differs from other definitions based solely on the cost of transfer in two plausible though rare situations. Stickiness as eventfulness will classify as sticky a non costly transfer of knowledge which does not meet expectations and it will classify as non sticky transfers of knowledge which, however costly, are done routinely by an organization and become a taken for granted part of organizational reality.

Seeing eventfulness as the defining characteristic of a sticky transfer of knowledge has operational advantages. Eventfulness can be detected by examining deviations from important milestones, by attending to supplemental resource allocation to compensate for cost overruns and by monitoring perceptual and objective satisfaction from the process of transfer. All of these measures might be easier to obtain and compare across disparate settings than are absolute cost measures.

Origins of Stickiness: Barriers to Knowledge Transfer

This section propounds origins of stickiness. The ground logic is that of the mathematical theory of communication (Shannon and Weaver, 1949). Viewed from the perspective of this theory, a transfer of knowledge is likened to the transmission of a message from a source to a recipient in a given context. Characteristics of the message or the situation that limit the amount of knowledge that can be transferred render the transfer stickier. Arrow (1971) suggested two such characteristics: the credibility of the source and the ability of the recipient to "decipher" the message. Arrow's logic is developed systematically for the four components of the communication metaphor, i.e. source, recipient, message (knowledge transferred) and context. In doing so, pertinent conceptual insights are incorporated into the research framework. Origins of stickiness are classified as intrinsic to the knowledge transferred or as pertaining to the situation in which the knowledge is transferred. The predictions of the framework are formalized in nine propositions.

Characteristics of the knowledge transferred

Successful replication of knowledge, in a different setting, may be compromised by idiosyncratic features of the new context in which knowledge is put to use. The theory of uncertain imitability (Lippman and Rumelt, 1982) posits that the fundamental factor that hinders the precise replication of results from the use of knowledge is causal ambiguity. Causal Ambiguity obscures how the features of the new context affect the results of the replication effort. Because causal ambiguity can be reduced only through costly trial and error,

H1: *Ceteris paribus, causal ambiguity in the use of knowledge is positively correlated with stickiness*

When the claim that knowledge will be effective in solving the recipient's problem is partly speculative it will be harder to induce a potential recipient to engage in the transfer of that knowledge (Rogers, 1983) and it will be also harder to legitimize controversial integration efforts (Nelson and Winter, 1982). Thus,

H2: *Ceteris paribus, absence of proof of the usefulness of the source's knowledge is positively correlated with stickiness*

Characteristics of the transfer situation

The motivation of the source of knowledge to support a transfer may impact the degree of difficulty experienced during a transfer. The source may be reluctant to share crucial knowledge for fear of losing ownership, a position of privilege, superiority or it may be resentful of not being adequately rewarded for sharing hard-won success. Accordingly,

H3: *Ceteris paribus, lack of motivation of the source is positively correlated with stickiness*

Difficulty in a transfer of knowledge may also result from the lack of perceived reliability of the source (Arrow, 1971). The Aristotelian theory of persuasion suggests that an expert and trustworthy source is more likely to influence a recipient (cf. Perloff, 1993 ch. 6). When the source unit is not perceived as trustworthy or knowledgeable it will be more difficult to initiate a transfer from that source and its advice and example will be more openly challenged and resisted. Thus,

H4: *Ceteris paribus, lack of perceived reliability of the source is positively correlated with stickiness*

The motivation of a recipient to accept knowledge from an external source and engage on the activities necessary to utilize that knowledge may prove critical to insure a non-eventful transfer. Thus,

H5: *Ceteris paribus, lack of motivation of the recipient is positively correlated with stickiness*

The ability to exploit outside sources of knowledge is largely a function of the level of prior related knowledge. The stock of prior related knowledge determines the "absorptive capacity" (Cohen and Levinthal, 1990:128) of a recipient of knowledge. A recipient that lacks absorptive capacity will be less likely to recognize the value of new knowledge, less likely to assimilate that knowledge and less likely to apply it successfully to commercial ends. This may increase the cost of a transfer, retard its completion and even compromise its success. Thus,

H6: *Ceteris paribus, the lack of absorptive capacity of the recipient is positively correlated with stickiness*

A transfer of superior knowledge is effective only when the knowledge transferred is retained in use. Maintaining the use of new knowledge is facilitated by extending its use to the full logical extent and, when it displaces old knowledge, by taking explicit steps to terminate the use of old knowledge (Glaser et al., 1983). Studies of innovation and of the persistence of planned organizational change (e.g. Rogers, 1983:365, Goodman and Dean Jr., 1982:228; Glaser et al., 1983:221-251 for a review) have documented instances where the use of superior technical and organizational knowledge is discontinued after successful implementation suggesting that retention of the use of superior knowledge cannot be taken for granted. The ability of a recipient to institutionalize the utilization of new knowledge reflects its "retentive capacity". Absent this ability, initial difficulties experienced during the integration of the transferred knowledge may provide excuse for discontinuing its use, and when feasible, reverting to the previous status-quo (Zaltman, Duncan and Holbek, 1973). Thus,

H7: *Ceteris paribus, the lack of retentive capacity of a recipient is positively correlated with stickiness*

The organizational context may affect the gestation and evolution of initiatives to transfer knowledge. The same *transfer seed* that unfolds fully in one context, may grow timidly and ephemeral in another or, in a third context, remain unrecognized. Insofar as the context nurtures the development of a transfer seed, the gestation and evolution of a transfer could be likened to the germination of the seed of a plant in a seeding ground. Thus, an organizational context that facilitates the development of a transfer seed could be said to be *fertile*. Conversely, a context where transfer seeds mature no further could be said to be *barren*. Formal structure and systems, sources of coordination and expertise and behavior framing attributes of the organizational context can influence the number of attempts to transfer knowledge and the fate of these attempts (cf. Ghoshal and Bartlett, 1994). Consequently,

H8: *Ceteris paribus, a barren organizational context is positively correlated with stickiness*

Another important contextual aspect for both the source and the recipient of knowledge is the nature of their pre-existing relationship. A transfer of knowledge is likely to be an iterative process of exchange. The success of such exchange depends to some extent on the ease of communication (Arrow, 1974) and on the 'intimacy' of the relationship (cf. Marsden, 1990). An arduous, i.e. laborious and distant, relationship might create additional hardship to transfer knowledge. Thus,

H9: *Ceteris paribus, an arduous relationship between source and recipient is positively correlated with stickiness*

DATA AND METHOD

Hypotheses H1-H9 were tested through a two-step survey. The empirical setting for this test is the transfer of best practices inside the firm. The unit of analysis is the transfer. Special effort was directed to maximize the quality of data (Groves, 1987) – i.e. to access a theoretically relevant sample of firms and to minimize the incidence of measurement error. The resulting relatively high quality of data permitted in turn to select a robust and easily communicable method of analysis.

Data

Data was collected through a two step questionnaire survey. The first step of the survey was devised as a feasibility test. This test allowed self-selection of theoretically relevant companies and generated, for companies that cleared it successfully, a list of transfers to study and a list of parties involved in those transfers (i.e. of respondents). Theoretically relevant firms saw internal transfers of best practice as a corporate priority and were identified by seeking firms which were active in competitive benchmarking and by seeking best-in-class firms with many small scale comparable operations – e.g. retail banks or fast food chains. Over 60 companies initiated the feasibility test. Of the 60, 12 completed the test and eight were admitted to the second phase of the survey. Transfers for study were preferred when they matched closely the theoretical characteristics associated with the replication of an organizational routine (Nelson and Winter, 1982).

The second step of the survey was devised to test the conceptual framework. The final sample encompassed 271 returned questionnaires, spanning 122 transfers of 38 practices² making for a response rate of 61%. The sampling criteria sought to obtain a balanced perspective on each transfer by sending one questionnaire to the source, one to the recipient and one to a third party to the transfer. Regarding type of respondent, 110 questionnaires were received from source units, 101 questionnaires from recipients and 60 from third parties. Average item-nonresponse was lower than 5%. On average 7.3 questionnaires were received for each practice studied.

Measures

Dependent Variable: Stickiness as Eventfulness of Transfer

Stickiness was measured using a set of eight items corresponding to the so called technical success indicators of a project (Pinto and Mantel, 1990) – on time, on budget, and a satisfied recipient. The total score for stickiness was computed by adding the standardized scores (cf. Nunnally, 1978). Deviation in timing was measured as departure from the initial plan in reaching key milestones – the start of the transfer, the first day the practice became operational at the recipient and achievement of satisfactory performance. For these three items the five possible answers were 1:ADVANCED BY MORE THAN ONE MONTH, 2: ADVANCED LESS THAN ONE MONTH, 3: NOT RESCHEDULED, 4: DELAYED LESS THAN ONE MONTH, 5: DELAYED MORE THAN ONE MONTH. Two items measured departure of actual cost from expected cost on the source side and the recipient side. For these two items the five possible answers were 1:MUCH(>30%) MORE THAN EXPECTED, 2:SLIGHTLY MORE(<30%) THAN EXPECTED; 3: AS EXPECTED; 4:SLIGHTLY (<30%) LESS THAN EXPECTED, 5:MUCH LESS (>30%) THAN EXPECTED. Finally, three items measured recipient's satisfaction. One item measured adjustment in the recipient's expectations after gaining experience with the practice. The possible answers for this question were 1: DRAMATICALLY UPWARD, 2: SLIGHTLY UPWARD, 3: NO CHANGE, 4: SLIGHTLY DOWNWARD, 5: DRAMATICALLY DOWNWARD. Two items measured whether the recipient was satisfied with the quality of the practice and with the quality of the transfer. For these two items, the possible answers were 1: VERY SATISFIED, 2: SOMEWHAT SATISFIED, 3: NEITHER SATISFIED NOR DISSATISFIED, 4: SOMEWHAT DISSATISFIED, 5: VERY DISSATISFIED.

Operationalization of the Independent Variables

To insure the reliability and validity of the measurement system, multi-item scales were developed for all constructs. Table 1 below summarizes the Cronbach α and the number of items in each measure. Little empirical precedent existed to develop most of these measures. To develop the scales, a broad and thorough literature review helped generate the initial constructs and the items to measure those constructs. Intense and in-depth clinical work helped fine-tune the choice of constructs, and provided the anchor to select the most relevant items for those constructs, given the empirical context of this study, i.e. intra-firm transfer of best practice. Items were also

²The sample comprised both technical practices, e.g. Software validation procedures and Drafting Standards, and administrative practices, e.g. Activity Based Costing (ABC) and Upward Appraisal.

selected based on feedback obtained on the pilot questionnaire and further refined using the full data set. Space limitations preclude a detailed presentation of the operationalization (see Szulanski, 1995).

TABLE 1

Construct	Cronbach α	Items
<i>Causal Ambiguity</i>	.86	6
<i>Unproven Knowledge</i>	.67	3
<i>Source lacks Motivation</i>	.93	13
<i>Source is not perceived as Reliable</i>	.64	8
<i>Recipient lacks Motivation</i>	.93	14
<i>Recipient lacks Absorptive Capacity</i>	.83	9
<i>Recipient lacks Retentive Capacity</i>	.81	6
<i>Barren Organizational Context</i>	.77	14
<i>Arduous Relationship</i>	.71	3

RESULTS

The performance of the measurement model is satisfactory. In terms of reliability, all but two scales have Cronbach $\alpha > 0.7$, two are marginally below. The unidimensionality of all 10 scales received adequate support. All construct pairs met the discriminant validity test at $p < 0.0001$.

TABLE 2
Regression

Variable	Beta
Causal Ambiguity	0.09
Unproven Knowledge	0.02
Source lacks Motivation	-0.24**
Source not perceived as Reliable	0.11
Recipient lacks Motivation	0.22**
Recipient lacks Absorptive Cap.	0.45***
Recipient lacks Retentive Cap.	-0.29**
Barren Organizational Context	0.04
Arduous Relationship	0.31***

Adj-R² = 0.42 F_{9,88} = 8.95***

** : p < .05; *** : p < .01

Table 2 presents the results of the standardized regression of the outcome based measure of stickiness. The findings suggest that the lack of absorptive capacity of the recipient, an arduous relationship between the source and the recipient and lack of motivation by the recipient are the primary determinants of the manifest consequences of stickiness. Two other factors, the lack of motivation of the source unit and the lack of retentive capacity of the recipient, while as important as these three, have opposite sign. All other variables, perceived reliability, causal ambiguity, unproved knowledge and barren organizational context are insignificant even if their signs are consistent with predictions. Taken collectively, the findings point to the attributes of the situation as the primary origins of stickiness.

Because all coefficients were expected to be positive, the negative coefficient associated with Source lacks Motivation and that associated with Recipient lacks Retentive Capacity are unexpected results. The negative sign associated with the lack of motivation of the source suggests that “excess” motivation of the source might be deleterious. Close scrutiny of the evidence reveals transfers initiated and propelled by the enthusiastic push of highly motivated sources. In some of these transfers, impatient enthusiasm either crowded-out meticulous planning or won over the uncertainty of costs thus yielding transfers that ultimately run over budget. This observation could explain the positive relationship between source motivation and stickiness³. The negative sign associated with the Lack of retentive capacity of the recipient could be interpreted as the height of the unlearning barrier. Indeed a high level of retentive capacity – i.e. periodical retraining, regular measurement and correction of performance problems, clear reward structure, clarity of roles – represents, to some extent, formalized routine use of *previous* knowledge. Thus, the higher the retentive capacity of a recipient, more extensive unlearning will be required to replace prior knowledge. Dismantling retentive capacity for prior knowledge contributes to stickiness. Because all transfers in this sample were reported between four to eight months after the first day that the recipient started using the transferred knowledge – a relatively short time to develop effective retentive capacity for the use of new knowledge let alone to reveal the influence of that capacity on stickiness – the timing of the survey seems premature to capture the effects of retentive capacity on the use of new knowledge and therefore it might be capturing instead the consequences of surmounting the difficulties to unlearn prior knowledge.

Robustness of the Findings

Missing data was deleted case-wise leaving a total of 98 data points out of 271. To establish the robustness of the results, separate analyses were conducted using alternate methods for handling missing data. The reported results are replicated despite wide variations in sample size (98-271). Ridge regression was used to rule out multi-collinearity. No company specific or perspective specific effects could be detected.

DISCUSSION AND CONCLUSION

Pointing to the disappointing explanatory power of studies based on a communications metaphor, Attewell (1992) questioned the usefulness of this metaphor for the study of transfers of complex knowledge. The considerable explanatory power achieved in this study, using that metaphor, suggests that factors other than the choice of metaphor, such as noisy data or poor operationalization, might be responsible for the poor explanatory power achieved in some of those studies, thus restoring hope in the value of a communications metaphor for the study of knowledge transfer. The findings provide also additional insight into a seemingly fundamental strategic dilemma in the exploitation of superior knowledge. In exploiting knowledge a company faces a dilemma: unsticking valuable knowledge to expand the scope of its use makes

³The diffusion of innovations literature has been accused of a pro-innovation bias (Rogers, 1983). This finding may be pointing out to a similar “pro-transfer” bias.

imitation more likely and risks reducing rather than increasing the overall value of that knowledge to the firm. Thus, exploiting knowledge through rapid internal or external expansion could be a double edged sword (Winter, 1987). When stickiness originates solely in the characteristics of the knowledge transferred this dilemma may be very significant. However, to the extent that stickiness originates predominantly in the characteristics of the situation, as the findings indicate could be the case, voluntary and involuntary transfers of knowledge need not be tightly coupled phenomena. Even after completely unlocking the secrets of superior knowledge, a prospective imitator may need to surmount other formidable barriers to imitation.

Because general theoretical criteria were used to select the companies and the practices for this study, the findings should be broadly generalizable to transfers of knowledge already in use. However, caution should be used in interpreting the results because of the extensive use of subjective data and survival bias in the selection of transfers. Limitations notwithstanding, this study is, to my knowledge, the most extensive systematic study of transfer of practices within organizations, and the first to seek explicitly a balanced perspective by triangulating the perceptions of the source, the recipient and an external observer to the transfer. It is hoped that it provides a useful starting point for future empirical research on the problem of stickiness. From a practical standpoint, the results suggest that prepared recipients, an intimate relationship between source and recipient and processes and norms that support unlearning of prior knowledge go a long way in reducing barriers to transfer best practices inside the firm. When barriers are low, transfers of best practice are simply non-events.

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