



Paper to be presented at the DRUID 2012

on

June 19 to June 21

at

CBS, Copenhagen, Denmark,

Routine Structure and Knowledge Management: Impacts on Routine Attributes, Value and Imitability

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Abstract

Organizational routines play an important role in a number of organizational and strategic management theories, including the capability, resource-based, knowledge-based, evolutionary and practice perspectives. However, to date the concept of organizational routines has proven difficult to operationalize. This has severely restricted the use of this concept in empirical work and limited new theory development. Building on prior work conceptualizing routines as (components of) firm capabilities and on the knowledge-based view of the firm, this paper identifies a number of attributes which can be used to characterize organizational routines. I then discuss the relationships between routine attributes, routine value and routine imitability, as well as the moderating role of the environment in which the organization competes. Finally, I consider how a firm's choices regarding routine structure and knowledge management affect routine attributes, and how these relationships are moderated by the broader organizational context. The resulting theoretical framework can be used to consistently theorize about and analyze routines that operate in different contexts. This framework contributes to the literature on organizational routines by opening the door for more empirical work that takes the routine as its unit of analysis, and by providing a foundation for new theory development.

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February 2012

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1 Introduction

Organizational routines - repetitive patterns of interdependent organizational actions (Parmigiani and Howard-Grenville, 2011) - play an important role in a number of organizational and strategic management theories. First introduced in work by the Carnegie School (Simon, 1947; March and Simon, 1958; Cyert and March, 1963), they play a number of roles in evolutionary theory including that of ‘genes’ (Nelson and Winter, 1982), are used to encode inferences from history in the process of organizational learning (Levitt and March, 1988), and are argued to be key building blocks of core organizational capabilities (Nelson, 1991). Recent work on dynamic capabilities has also given the concept of routines prominence in arguing for their centrality in the creation of firm capabilities to identify, create and exploit opportunities, and to reshape the firm while doing so (Teece, Pisano, and Shuen, 1997; Eisenhardt and Martin, 2000; Teece, 2007). Despite the important role played by the concept of routines in these theories, empirical work using routines as a unit of analysis has been limited by the difficulties associated with operationalization of the concept, with a recent review finding only 20 empirical papers using the concept of routines published in high-quality management journals since 1996 (Parmigiani and Howard-Grenville, 2011).

Empirical work to date that has used the concept of routines can be usefully

classified as being based on either practice or capability perspectives (Parmigiani and Howard-Grenville, 2011). While work taking the practice perspective is mainly interested in how routines operate and in their internal dynamics (e.g. Feldman, 2000; Howard-Grenville, 2005; Zbaracki and Bergen, 2010), work from the capability perspective concerns itself with the functions of routines in organizations and with how they influence organizational performance. As this paper is concerned with the antecedents and performance consequences of routine attributes, its main contribution is to the capability perspective on routines. Pentland and Feldman (2008) make a further useful distinction between artifacts designed to codify routines, and between ostensive and performative aspects of routines. While artifacts such as rule books may represent the ideal of a routine (normally in the eyes of management), the ostensive aspect of the routine refers to the narrative about the routine provided by participants or observers, while the performative aspect relates to specific actions taken by routine participants at specific times and in specific places. As this paper strives to identify the relationships between routine structure, routine attributes and organizational performance in the relatively short term during which the routine can be considered more or less stable, any operationalization of the proposed framework is likely to rely mostly on data about ostensive aspects of routines and on information recorded in artifacts. While the performative aspects of routines play an important role in routine change and stability over time (Feldman, 2000, 2003; Feldman and Pentland, 2003), these processes have been examined in some detail in prior work and are outside of the scope of this paper. Furthermore, observation of the performances of which a routine as executed consists is likely to be very difficult due to these performances being spatially and temporally distributed throughout the organization.

Empirical work conceptualizing routines as (components of) organizational ca-

pabilities has paid little attention to potential heterogeneity of routines that are designed to serve the same purpose in different firms (e.g. Karim and Mitchell, 2000; Knott, 2001; Zollo, Reuer, and Singh, 2002), in effect treating routines as a ‘black box’ (Pentland and Feldman, 2005). Work that does take routine heterogeneity into account either treats differences between routines as uni-dimensional (Aime *et al.*, 2010; Mitchell and Shaver, 2003; Peng, Schroeder, and Shah, 2008), or focuses on differences in routine components which are largely industry-specific and therefore difficult to generalize to other contexts (Knott, 2003). Both the lack of nuance on the one hand and the context-specificity on the other hinders knowledge accumulation through comparing and contrasting the results of different studies. An exception to this general lack of attention to routine heterogeneity and its performance implications is a case study of the model changeover process in NUMMI, a U.S.-based Toyota subsidiary (Adler, Goldoftas, and Levine, 1999). This case study describes the model changeover process used by NUMMI in some detail and contrasts it with the process used by U.S. car manufacturers. The differences between the processes are convincingly argued to underpin the superior performance, both in terms of efficiency and flexibility, of NUMMI’s changeover routine. Another exception is an in-depth case study of the pricing process of a large manufacturing firm (Dutta, Zbaracki, and Bergen, 2003) in which the authors argue that the pricing process constitutes a capability that may help or hinder a firm in appropriating value. However, in this study a comparison is made between the pricing routines used in a single firm and their effectiveness before and after firm investment in the routine, while no comparison is made between the focal firm’s routine and pricing routines used by competing firms.

This paper contributes to the literature on organizational routines by building on prior work conceptualizing routines as (components of) firm capabilities and on the

knowledge-based view of the firm to identify a number of attributes which can be used to characterize organizational routines. I then discuss the relationships between routine attributes, routine value and routine imitability, as well as the moderating role of the environment in which the organization competes. Finally, I consider how a firm's choices regarding routine structure and knowledge management affect routine attributes, and how these relationships are moderated by the broader organizational context. The resulting theoretical framework can be used to consistently theorize about and analyze routines that operate in different contexts. I hope that this framework will open the door for more empirical work that takes the routine as its unit of analysis, and that it will provide a foundation for new theory development.

2 Routine Attributes, Value and Imitability

2.1 Routines as potential sources of value for the organization

Resource-based theory states that firm competitive advantage is dependent on the firm having a configuration of resources and capabilities that is valuable and rare. If the resource and capability configuration is also inimitable and non-substitutable, it can become the source of sustained competitive advantage (Barney, 1991). In this paper I discuss how organizational choices about routine structure and knowledge management affect routine attributes that determine both how valuable the routine is to the organization, and thus the extent to which it may serve as a source of competitive advantage, and the ease with which the routine can be imitated by another firm.

A hierarchy of organizational routines, consisting of lower order routines for doing

various tasks and higher order routines for invoking these in a particular combination in order to accomplish a particular job, has been proposed as being a key building block of the concept of organizational capabilities (Nelson, 1991). While the majority of the discussion that is to follow applies to both higher and lower order routines, our focus will be on higher order routines, such as new product development or pricing, as these are likely to play a more important role in the creation of competitive advantage than the lower order routines which they call into action. Such higher order routines may well be thought of as being capabilities in themselves, and some prior work on capabilities has used these terms interchangeably (e.g. Eisenhardt and Martin, 2000).

A number of examples in extant literature illustrate the potential of routines to create value for an organization or to allow an organization to capture more of the value that it creates. Adler, Goldoftas, and Levine (1999) describe how the model changeover routine in a high-performing U.S.-based Toyota subsidiary differs from those used by the Big Three U.S. car manufacturers and convincingly argue that these differences in the routines used lead to the observed differences in routine outcomes. Dutta, Zbaracki, and Bergen (2003) present a case study of how the pricing routine of a large manufacturing firm changed over time and present evidence that these differences led to improved routine performance which improved the ability of the firm to appropriate value through effective pricing. Finally, Aime *et al.* (2010) use data on American Football matches to present evidence that high order routines conferring a competitive advantage to the organization are stable to the loss of key personnel involved in their execution, but that organizational competitive advantage is eroded as these routines diffuse.

2.2 Routine attributes and routine value

Three routine attributes which drive the value of a routine are mentioned in the literature on routines as (components of) firm capabilities: quality, cost, and speed.

Routine *quality* refers to the quality of the outcome produced by the routine. For example, the model changeover routine used by NUMMI and Toyota produced a high quality outcome as it resulted in the production of new car models having only a slightly higher defect rate than the world-class quality of previous model production at the plant during the 1993 model changeover. Furthermore, the slight quality difference took only a few weeks of full production to disappear during this changeover, while world-class quality levels were restored within four months of beginning full production on a new truck model in 1995. By contrast, quality of production suffered substantially during model changeovers at the Big Three U.S. car manufacturers and took between 3 months and a year to return to normal levels between 1987 and 1995 (Adler, Goldoftas, and Levine, 1999).

Routine *cost* captures the cost of the routine to the organization in terms of the resources that are employed in its execution. These costs may include both the costs that are incurred every time that the routine is performed, such as the employee hours spent performing tasks as part of the routine, as well as the costs associated with the investment in human and physical capital (e.g. training costs, costs of information technology systems) which is necessary for the execution of the routine. As we are interested in comparing routines that serve the same purpose in different firms, the above costs are always relative to the costs incurred by the organization(s) that form the comparison set. An example of a relatively costly routine is the pricing process used by a large Midwestern manufacturing firm to price 8,000 products that is the focus of the case study carried out by Dutta, Zbaracki, and Bergen (2003).

The firm in question invested heavily in improving its routines to identify competitor prices, set pricing strategy, and consistently translate this strategy into actual prices offered to its customers. The resulting routine was more costly than the pricing routine which the firm had used previously, but it was also of a higher quality as it allowed the firm to appropriate a greater share of value created than did the previous routine.

Routine *speed* is the amount of time that elapses from the point in time at which the routine begins to the point in time at which the routine produces an outcome. This attribute is likely to be particularly important in industries where the time that elapses between strategic actions, such as the introduction of new products, is an important factor in competitive outcomes. The model changeover cycle used by Toyota when it began to compete with U.S. manufacturers in the 1970s was significantly shorter than the cycles used by the U.S. Big Three auto companies. While the interval between major model changes of the U.S. Big Three varied from four to eight years, Toyota introduced new models every four years. Furthermore, while model change routines of the Big Three in 1994 resulted in between 60 and 87 days of plant closure, NUMMI was closed for only 5 days during comparably complex model changeovers in 1993 and 1995 (Adler, Goldoftas, and Levine, 1999).

Whereas routine quality and routine speed are positively related to the overall value of a routine to an organization, higher routine cost reduces the value of the routine, other things being equal. A routine that produces high-quality results is of more value to an organization than one which produces lower-quality output. A fast routine that can produce an outcome quicker than a routine used by a competitor is also going to be valuable for the organization, especially if the routine in question plays an important role in time-based competition. Finally, a routine that uses fewer resources is going to be more valuable to an organization than one which uses more

of the organization's scarce resources.

The above statements are all made with implicit *ceteris paribus* clauses which are not likely to hold in practice as there are trade-offs between the three attributes discussed above. The most important trade-off is likely to be between routine quality and both routine speed and routine cost. This is because routines that produce high-quality outcomes are likely to require greater co-ordination between lower order routines (for example, between product design and focus group testing in a new product development context) and will as a result of this use more resources and/or more time to complete than routines involving less co-ordination which will likely produce outputs of a lower quality. Some evidence of these tradeoffs can be seen in both of the case studies referred to above (Adler, Goldoftas, and Levine, 1999; Dutta, Zbaracki, and Bergen, 2003). There is also likely to be a trade-off between routine speed and routine cost. This tradeoff is due to the well documented phenomenon of time compression diseconomies. Reducing the duration of projects undertaken by the firms generally raises project costs as more employees and financial resources are committed to the project, with the cost increase being greater for more significant reductions in project duration (Scherer, 1967, 1984; Dierickx and Cool, 1989). The empirical evidence of such diseconomies in an innovation context is plentiful (see e.g. Graves, 1989), and these diseconomies are also likely to exist in other contexts.

The trade-offs described above mean that the value of a routine with a given combination of the three routine attributes to an organization will be highly contingent on the broader environmental context in which the organization operates. Three factors in the environmental context are particularly likely to play an important moderating role: munificence, dynamism and the intensity of competition. For example, an organization that is operating in an environment undergoing rapid discontinuous change is likely to value the speed of a new product development routine

above other attributes as a fast entrance into newly emerging segments may allow the organization to establish a strong competitive position before rival organizations enter. In contrast, an organization operating in a highly competitive but stable environment is likely to consider a high quality or a low cost of its new product development routine to be more valuable than a high routine speed. Organizations operating in an environment in which resources are becoming increasingly scarce are likely to be concerned about keeping costs low and so may prioritize low cost over other routine attributes.

2.3 Routine imitability

The previous section argued that routine quality, speed, and cost affect the value of the routine to the organization. If a routine creates more value for the organization or helps the organization appropriate more value than routines which serve the same purpose in competing organizations then the routine can be a source of competitive advantage. However, in order for this competitive advantage to be sustainable, the routine must not be easily imitable, nor easy to find a substitute for (Barney, 1991). In this section I will propose one more routine attribute in addition to the three already identified and discuss the effects that this attribute has both on the value of the routine and on how easy the routine is for competitors to imitate.

The knowledge-based view of the firm argues that knowledge, both tacit and explicit, is the foundation of organizational sustained competitive advantage, and that such knowledge resides in the organization's employees (Grant, 1996). I therefore propose that the extent to which employees involved in a routine have an understanding of the routine as a whole is a key attribute which affects both the value of the routine to the organization and the ease with which the routine can be trans-

ferred to another organization. The greater the *knowledge of the routine* possessed by employees, the greater the imitability of the routine because competing organizations that wish to copy the routine can gain more knowledge about the routine by hiring an (ex-)employee of the focal organization.

As well as increasing the imitability of the routine, a greater knowledge of the routine as a whole possessed by employees is likely to result in the routine being more valuable. This is because the loss of an employee involved in the routine to competitors will not result in the organization losing the ability to perform the routine as the employees remaining in the employ of the organization will continue to possess sufficient knowledge of the routine as a whole to facilitate its continuing operation. Such resilience of the routine to changes in personnel will be particularly valuable to organizations that compete in environments in which there is an intensely competitive market for key employees.

An empirical example of how employee knowledge can affect organizational performance is provided in Aime *et al.* (2010). The authors use data on head-to-head competition in American Football to provide evidence that the mobility of employees possessing a broad knowledge of the advantageous offensive routines used by the San Francisco 49ers led to the diffusion of these routines among the team's competitors. The authors also provide evidence of the value of employee knowledge of the routine to the focal organization by finding that the loss of employees with knowledge of the team's offensive routines to competing teams did not result in the 49ers losing the ability to execute these routines. The above discussion suggests that greater employee knowledge of the routine has somewhat of a paradoxical relationship with the organizational competitive advantage. Greater employee knowledge of the routine it is likely to be valuable for the organization by making the routine more robust to changes in personnel, thus making any competitive advantage derived from the

routine more sustainable. However, greater employee knowledge of the routine is also likely to result in a higher risk of the routine being imitated by competitors as these will be better able to copy the routine by hiring current or former employees of the organization, so making any competitive advantage arising as a result of the routine less sustainable.

3 Effects of Routine Structure and Knowledge Management Choices on Routine Attributes

Having identified four routine attributes that drive the value of a routine to an organization and its imitability, in this section I discuss four aspects of routine design that determine routine attributes. Two of these choices, routine modularity and routine parallelism, concern routine structure and two, codification and the use of cross-functional teams, concern the way in which the knowledge used in the routine is managed. Prior work has shown that routines are rarely executed in practice in a manner that is fully consistent with managerial design, so by routine design I refer not to the idealized design of the routine captured in artifacts, but to the ostensive aspect of the routine as understood by those involved in its functioning.

3.1 Routine structure

Routine *modularity* reflects the extent to which the subroutines called by the higher order routine are independent. A completely modular routine consists of a number of subroutines which do not interact with each other. When activated, each subroutine is carried out independently until it produces an output, with the outputs of all the subroutines combined to produce the routine output. A highly integrated routine, on

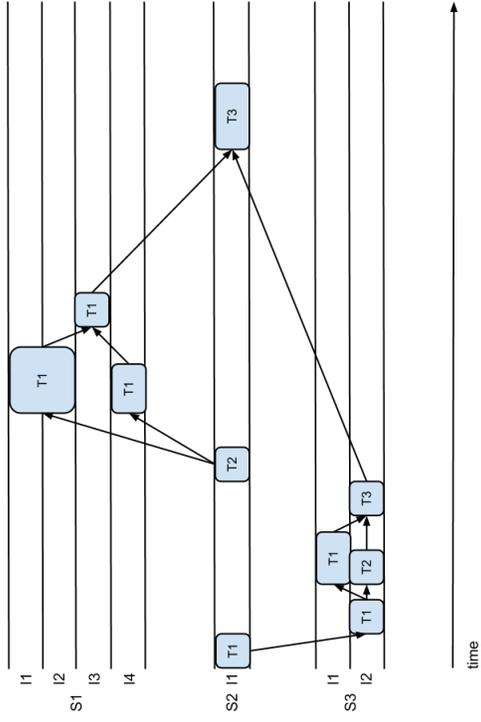
the other hand, consists of a number of subroutines that are highly interdependent and frequently transmit outputs to one another. Modular routines will result in fewer employees having broad knowledge of the routine compared to routines that are more integrated as only the employees involved in integrating the outputs of different subroutines will be in a position to have somewhat broad knowledge of all of the subroutines that are used as the routine is carried out.

Routine *parallelism* captures the extent to which the subroutines activated by the higher order routine are executed in parallel or sequentially. A more parallel routine is likely to be faster than a sequential one as less time is spent waiting for subroutines to produce outputs that enable the execution of the next subroutine(s). However, this higher speed is likely to come at a higher cost due to a greater need for coordination between integrated subroutines that are operating in parallel in order to ensure that their outputs will not be incompatible, or due to a greater investment in precisely specified interfaces which ensure compatibility between outputs of modular subroutines.

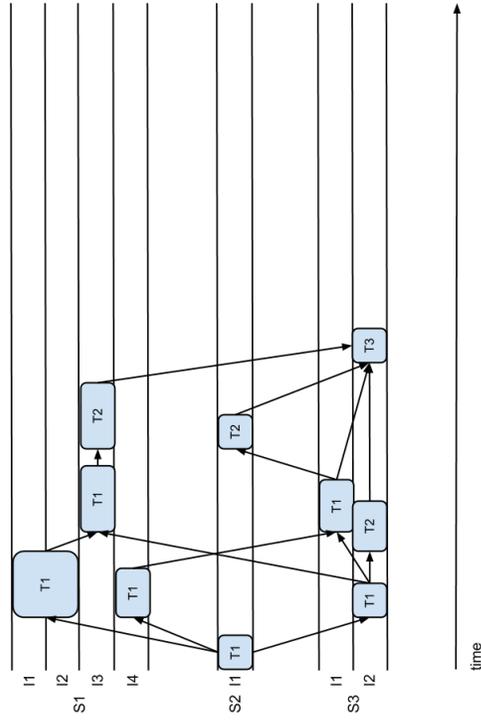
Both modular and integrated routines can be either sequential or highly parallel. Figure 1 illustrates four possible combinations of high and low modularity and parallelism in a single routine consisting of three subroutines. For simplicity in these examples a given individual is assumed to be involved in only one subroutine.

Panel (a) is an example of a routine that is both modular and parallel. Subroutines 1 and 3 function concurrently and independently of each other once given the signal to begin by subroutine 2. Subroutine 2 then integrates the outputs of subroutine 1 and 3 to produce the overall output of the routine. An example of such a routine is the development of a new version of an open source software project, such as the Linux operating system (for brief a discussion of Linux as an open source platform, see Gawer and Cusumano, 2002). Due to the operating system's modular

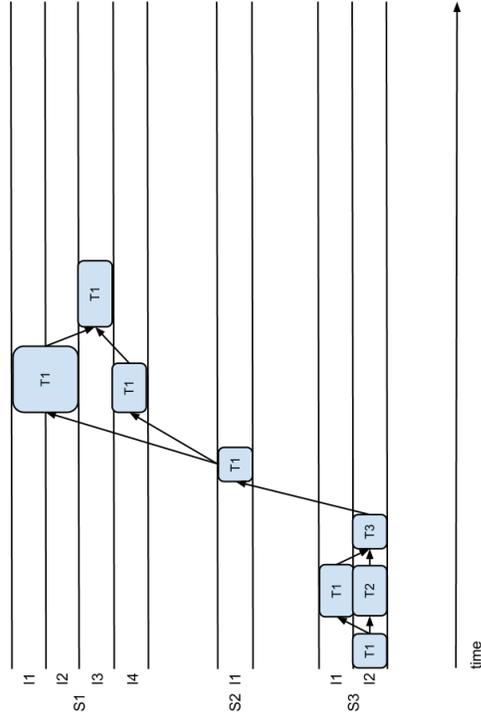
Figure 1: Routine Structures



(a) Modular/Parallel Routine



(b) Modular/Sequential Routine



(c) Integrated/Parallel Routine

(d) Integrated/Sequential Routine

design, different components of the system were worked on concurrently by different groups of developers. The head developer Linus Torvalds suggested directions for development of the operating system to different groups and integrated the outputs of their development subroutines into the next version of the product.

Panel (b) represents a routine that is modular but sequential. Here subroutine 2 again plays an integrating role but subroutine 1 is carried out only once subroutine 3 has been completed. An example of such a routine is a concert consisting of several different pieces of music, where each piece can be thought of as a subroutine. While each piece of music is independent of the others and so the routine as a whole is modular, the pieces are performed in sequence.

Panel (c) is an illustration of a routine that consists of a number of highly integrated subroutines running largely in parallel. Different tasks within each subroutine take inputs from and send outputs to other subroutines that are concurrently in progress. An example of such a routine is the Toyota model changeover process described in Adler, Goldoftas, and Levine (1999). This routine was highly integrated with design, engineering and manufacturing departments all being involved in the changeover planning cycle from the beginning. The Toyota changeover process was also less sequential than the model changeover routine traditionally used by the Big Three U.S. auto manufacturers as Toyota manufacturing employees were involved in the planning of the 1993 changeover process immediately after the prior changeover process was completed. By contrast, manufacturing employees in the Big Three auto manufacturers became involved in the changeover process only when the factory that they were working in was refitted and ready for production of the new model, having been laid off for the duration of the refitting.

Finally, panel (d) shows a routine that is integrated and sequential. Subroutines which are part of a routine structured in this manner are interdependent as the

outputs from one subroutine are required as inputs into other subroutines, but there is little concurrence as only one subroutine is operational at a given point in time. An example of such a routine is the sandwich preparation process at Subway. After the customer order is taken, a number of subroutines such as heating the bread, putting in the sandwich filling, adding salad, wrapping the sandwich, and taking payment are performed in sequence with each subroutine taking the output of the previous one as an input.

The effect of the above routine design choices on routine attributes is likely to be moderated by other factors in the organizational context. For example, the high performance of Toyota's highly integrated and parallel model changeover process has been argued to depend upon the organization's employees being highly trained and upon high levels of trust existing between management and employees (Adler, Goldoftas, and Levine, 1999). The kind of technology used by the organization in executing the routine is also likely to play an important moderating role in the relationship between routine structure and routine attributes, as illustrated by a number of case studies (e.g. Gawer and Cusumano, 2002; Dutta, Zbaracki, and Bergen, 2003). A further contextual factor that may moderate the effect of routine structure on routine attributes is the extent to which organizational members involved in performing a routine are concurrently required to perform other routines. Organizational members who are concurrently involved in the performance of several routines will be required to allocate their attention and energies between the routines and this may lead to less effort being put into the performance of a focal routine than if there were no other routines being carried out concurrently using overlapping resources.

3.2 Knowledge management

Codification is a measure of the extent to which the routine is based upon codified explicit knowledge. The more codified the routine, the greater is the extent to which each employee involved in the routine has knowledge of the routine as a whole, and the easier it is to replicate the routine in a different organization by hiring away employees. A second effect of codification is a co-ordinating one that increases the routine's quality by standardizing the manner in which various lower order routines are performed over time or across different units of the organization. An example of the the standardizing effect of codification increasing routine quality over time can be seen in the Dutta, Zbaracki, and Bergen (2003) case study of the pricing process of a large manufacturing firm. This process was built upon a codified pricing system consisting of a database of prior price decisions and rules for making and recording new decisions. Before this system was introduced the firm's senior pricing manager often did not have complete information about the price that a given customer had paid for a product in the previous year or about the reasoning that had led to the pricing decision. This lack of information and inconsistency in pricing led to low routine reliability as pricing decisions would frequently have to be revised after complaints from customers about price changes that the organization could not justify. With the introduction of the codified pricing system, pricing inconsistencies were substantially reduced and managers were better able to justify price changes to customers. Franchise organizations provide an example of the role that codification can play in determining the quality of a routine across different units of the organization. For example, Knott (2001, 2003) provides evidence of the key role of codified, explicit knowledge in the transfer of routines from franchisor to franchisee in the quick printing industry.

The use of *cross-functional teams* refers to the extent to which the routine integrates and co-ordinates the knowledge of employees involved in different subroutines through the formation of teams that contain a mix of employees involved in different subroutines. The use of cross-functional teams is likely to result in greater employee knowledge of the routine as a whole as being part of a cross-functional team will involve employees being involved in day-to-day communication with employees involved in subroutines different to their own. Using such teams is also may lead to greater routine quality through improved co-ordination between lower order routines. NUMMI's use of cross-functional teams in its model changeover process is one of the factors that has been argued to lead to the superior performance of this routine in comparison with the model changeover routines used by the U.S. Big Three car manufacturers (Adler, Goldoftas, and Levine, 1999). These increased employee knowledge of the routine and quality effects are likely to come at a cost as the usually highly experienced employees involved in the cross-functional teams will have significantly less time to dedicate to their normal functions in their respective subroutines.

The broader organizational context is again likely to play an important moderating role on the effects of these knowledge management choices on routine attributes. For instance, the success of codification in improving employee knowledge of the routine and routine quality is likely to be dependent on how accessible the codified information is to employees involved in the routine. An organization with an information technology system that allows all employees access to certain codified knowledge is more likely to benefit from codification than an organization that lacks such a system and in which codified information is less accessible to employees as a result. The success of cross-functional teams is likely to depend on different organizational factors, such as trust and a shared organizational culture. If employees involved

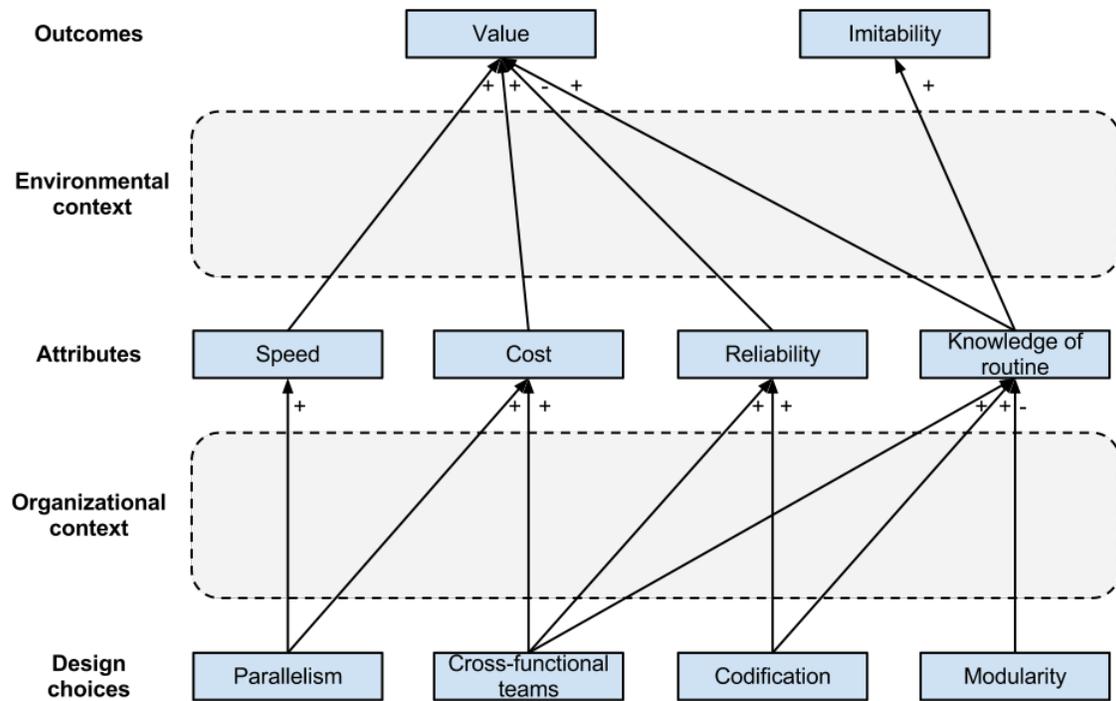
in cross-functional teams have low trust in employees from other departments it is unlikely that they will be as forthcoming in making their knowledge accessible to the rest of the team, thus reducing the effectiveness of these teams in increasing employee knowledge of the routine and in improving routine quality. Even if trust is present, differences in the cultures of team members from different organizational departments is likely to reduce the ability of employees to absorb the knowledge of team members involved in different subroutines.

4 Discussion

An overview of the framework proposed in this paper is presented in Figure 2. This framework represents an attempt to explore some potential connections between routine structure and knowledge management choices, routine attributes, and the value of a routine to an organization and the routine's imitability. Much remains to be done if this framework is to be empirically investigated and/or if it is to become useful in building new theory about the role of routines in creating and sustaining organizational competitive advantage.

The potential usefulness of this framework in advancing research on routines lies largely in its amenability to empirical testing. Information on routine structure and knowledge management choices of the organization, as well as information about the factors in the broader organizational context that may moderate the relationships between routine attributes, structure and knowledge management, could be collected through interviews and/or surveys of organizational members involved in the routine of interest. Data collected in this manner would aim to capture the ostensive aspect of the routine and care would need to be taken to ensure that the points of view of a variety of routine participants are elicited in order to gain an overview of the routine

Figure 2: Framework



that does not rely on the likely biased narrative provided by a single organizational member.

Measures of routine attributes could be constructed using artifacts such as logs, accounts or reports in organizations in which access to such artifacts can be negotiated and where these artifacts contain reasonably accurate measures of the relevant information. In cases where such information is not accessible from artifacts, interviews and/or surveys could be extended to include questions regarding routine attributes.

Finally, measures of routine outcomes and of aspects of the broader environmental context in which the organization of interest competes are likely to be available in secondary data sources. For example, the value of a routine to an organization could be evaluated by considering the cross-sectional or longitudinal correlations between routine attributes and measures of organizational performance such as productivity or profitability, with other factors known to affect these outcomes controlled for. For environmental factors, data on industry sales could be used to construct measures of environmental munificence and dynamism following commonly used procedures (see, e.g. Dess and Beard, 1984; Nadkarni and Narayanan, 2007), while concentration indices could be used to proxy for the extent of competition in the environment.

If the goal of the empirical study is to collect data on routines serving a similar purpose in different organizations, the surveys or interviews used to get measures of routine structure and knowledge management choices will need to be designed using an etic approach that seeks to collect data on the routine as defined by the researcher in order to ensure that the data collected describe functionally similar phenomena in different organizations. If the empirical study is instead focused on evaluating variation in the structure and performance of a given routine in a single organization over time, an emic approach to collecting data that relies on participant definitions

of the function of the routine may produce more accurate data on the routine as it is used in the organization.

On the theoretical side, future work should consider the specific moderating effects of organizational and environmental context variables on the relationships proposed in the framework. In particular, what aspects of the organizational context are likely to moderate the relationship between specific aspects of routine structure and specific routine attributes and how? What factors moderate the effects of choices about codification and the use of cross-functional teams on employee knowledge about the routine as a whole? Similarly, more theorizing is required about the specific environmental factors that moderate specific relationships between routine attributes and the value of the routine to the organization.

Further research should also examine potential interdependencies between choices relating to routine structure and knowledge management. Although treated as separate in this paper, the effects of routine modularity on routine attributes are likely to vary depending on the extent to which the routine is codified, for example, while an integrated routine consisting of several concurrent subroutines may require the use of cross-functional teams.

A final area for further theorizing involves recognizing that the variance of routine attributes may have an important effect on routine outcomes alongside the mean value of the attributes. For example, a routine that produces an outcome that is high-quality on average but varies widely from one run of the routine to the next may in some cases be less valuable to an organization than a more reliable routine that produces outcomes of a lower average quality. Similarly, the distribution of knowledge about the routine as a whole is likely to be important for the routine's imitability and for its value to the organization, and may actually be more important than a measure of the knowledge amount of knowledge about the routine possessed

by an imaginary average employee. Two routines with the same value of average employee knowledge of the routine could be very different in terms of their imitability and resilience to loss of employees if they differ in how knowledge about the routine as a whole is distributed. If one of the routines has one participant with complete knowledge with the remaining participants having little knowledge of the routine as a whole the implications for the routine's imitability would be very different to a routine in which all employees possessed the same moderate level of knowledge about the routine.

5 Conclusion

This paper has attempted to develop a theoretical framework that can be used for thinking about the relationships between routine structures and knowledge management choices, routine attributes, and the value and imitability of routines. Though much work remains to be done if routines are to become a common and useful unit of analysis in the study of organizations, I hope that the framework presented here facilitates the development of new empirical work investigating the role of routines in organizational capabilities connected to competitive advantage, leads to new theory building about routines as (components of) organizational capabilities.

References

- Adler PS, Goldoftas B, Levine DI. 1999. Flexibility versus efficiency? a case study of model changeovers in the toyota production system. *Organization Science* **10**(1): 43–68.
- Aime F, Johnson S, Ridge JW, Hill AD. 2010. The routine may be stable but the

- advantage is not: Competitive implications of key employee mobility. *Strategic Management Journal* **31**: 75–87.
- Barney JB. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**: 99–120.
- Cyert RM, March JG. 1963. *A Behavioral Theory of the Firm*. Prentice-Hall, Englewood Cliffs, NJ.
- Dess GG, Beard DW. 1984. Dimensions of organizational task environments. *Administrative Science Quarterly* **29**: 52–73.
- Dierickx I, Cool K. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science* **35**(12): 1504–1511.
- Dutta S, Zbaracki MJ, Bergen M. 2003. Pricing process as a capability: A resource-based perspective. *Strategic Management Journal* **24**: 615–630.
- Eisenhardt KM, Martin JA. 2000. Dynamic capabilities: What are they? *Strategic Management Journal* **21**: 1105–1121.
- Feldman MS. 2000. Organizational routines as a source of continuous change. *Organization Science* **11**(6): 611–629.
- Feldman MS. 2003. A performative perspective on stability and change in organizational routines. *Industrial and Corporate Change* **12**(4): 727–752.
- Feldman MS, Pentland BT. 2003. Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly* **48**(1): 94–118.
- Gawer A, Cusumano MA. 2002. *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation*. Harvard Business School Press, Boston, MA.

- Grant RM. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal* **17**: 109–122.
- Graves S. 1989. The time-cost trade-off in research and development: A review. *Engineering Costs and Production Economics* **16**: 1–9.
- Howard-Grenville J. 2005. The persistence of flexible organizational routines: The role of agency and organizational context. *Organization Science* **16**(6): 618–636.
- Karim S, Mitchell W. 2000. Path-dependent and path-breaking change: Reconfiguring business resources following acquisitions in the u.s. medical sector, 1978-1995. *Strategic Management Journal* **21**: 1061–1081.
- Knott AM. 2001. The dynamic value of hierarchy. *Management Science* **47**(3): 430–448.
- Knott AM. 2003. The organizational routines factor market paradox. *Strategic Management Journal* **24**: 929–943.
- Levitt B, March JG. 1988. Organizational learning. *Annual Review of Sociology* **14**: 319–340.
- March JG, Simon HA. 1958. *Organizations*. Wiley, New York, NY.
- Mitchell W, Shaver JM. 2003. Who buys what? how integration capability affects acquisition incidence and target choice. *Strategic Organization* **1**(2): 171–201.
- Nadkarni S, Narayanan V. 2007. Strategic schemas, strategic flexibility, and firm performance: The moderating role of industry clockspeed. *Strategic Management Journal* **28**: 243–270.

- Nelson RR. 1991. Why do firms differ, and how does it matter? *Strategic Management Journal* **12**: 61–74.
- Nelson RR, Winter SG. 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, MA.
- Parmigiani A, Howard-Grenville J. 2011. Routines revisited: Exploring the capabilities and practice perspectives. *Academy of Management Annals* **5**(1): 413–453.
- Peng DX, Schroeder RG, Shah R. 2008. Linking routines to operations capabilities: A new perspective. *Journal of Operations Management* **26**: 730–748.
- Pentland BT, Feldman MS. 2005. Organizational routines as a unit of analysis. *Industrial and Corporate Change* **14**(5): 793–815.
- Pentland BT, Feldman MS. 2008. Issues in empirical field studies of organizational routines. In *Handbook of Organizational Routines*, Becker MC, ed., 281–300. Edward Elgar, Cheltenham, UK; Northampton, MA.
- Scherer F. 1967. Research and development resource allocation under rivalry. *Quarterly Journal of Economics* **3**: 367–391.
- Scherer F. 1984. *Innovation and Growth*. MIT Press, Cambridge, MA.
- Simon HA. 1947. *Administrative Behavior*. Free Press, New York, NY.
- Teece DJ. 2007. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal* **28**: 1319–1350.
- Teece DJ, Pisano G, Shuen A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal* **18**: 509–533.

Zbaracki MJ, Bergen M. 2010. When truces collapse: A longitudinal study of price adjustment routines. *Organization Science* **21**(5): 955–972.

Zollo M, Reuer JJ, Singh H. 2002. Interorganizational routines and performance in strategic alliances. *Organization Science* **13**(6): 701–713.