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The Adoption of Open Innovation in Large Firms
Practices, Measures, and Risks

A survey of large firms examines how firms approach open innovation strategically and manage knowledge flows at the project level.

Sabine Brunswicker and Henry Chesbrough

OVERVIEW: We present a large-sample survey of open innovation adoption and management in large firms, a follow-up to a previous study. We repeat some of the survey measures from the first survey, finding that open innovation continues to be widely practiced in about 80 percent of responding firms. Outside-in open innovation is more often practiced than inside-out. In other words, large firms are net takers of free knowledge flows, in part because they are concerned about IP protection for outbound knowledge. When we added new measures to examine open innovation at the project level, we found that firms selectively manage knowledge flows into and out of projects and are formalizing processes as they move from problem definition to execution. We conclude with observations about the organizational challenges and risks of shifting to an open innovation approach.

KEYWORDS: Open innovation, Survey

Since the publication of Chesbrough’s seminal book in 2003, open innovation has attracted growing managerial attention, particularly among large firms. Substantial empirical evidence demonstrates that large firms increasingly make purposive use of external inputs from other parties, or allow others access to their underutilized assets and knowledge, in order to improve their R&D productivity. Prior work shows that open innovation is likely to remain pervasive as a component of R&D in large firms (Chesbrough 2003; Chesbrough and Brunswicker 2014). Further, firms are evolving in their application of open innovation, engaging in a variety of practices, from traditional bilateral arrangements (like alliances) to approaches (like communities) that involve multiple parties in an interactive relationship (Bagherzadeh and Brunswicker 2015). In some cases, firms even share internal knowledge without any immediate financial compensation (Dahlander and Gann 2010). As they have experimented with new forms of open innovation, firms have also sought new ways of managing and measuring its impact (Fetterhoff and Voelkel 2006). However, open innovation has not been sufficiently formalized, and, as our last survey revealed, managers are not satisfied with the routines and metrics available to them (Chesbrough and Brunswicker 2013).

The literature provides little assistance in this regard. Managers can look at project-level case studies, some of them published in RTM (see, for instance, Allarakha 2011; Kirschbaum 2005). However, such cases usually focus on a single project. This makes it difficult to understand what works across different projects. Another set of studies, including our own, focuses on the firm or business unit (Chesbrough and Brunswicker 2013, 2014; Laursen and Salter 2006, 2014). While these data are useful, managers need a more fine-grained analysis to manage open innovation at the project level, where many important decisions are made. As others have pointed out, larger
About 78 percent reported that their firms practice open innovation ... More than 50 percent of those firms adopted it as a strategy more than five years ago.

project-level studies are needed to advance the practice of open innovation (Du, Leten, and Vanhaverbeke 2014).

This study of open innovation in large firms, a continuation of the work described in our 2014 article, is set against this background. In addition to continuing the efforts begun in that first study to deepen understanding of how open innovation is adopted at the firm level, this study adds a focus on the project level. We also make a first attempt to respond to researchers’ call to examine not only successes but also failure cases (Tucci et al. 2016). In addition to confirming that open innovation remains a general trend, these new findings provide new insights into important questions about the management of open innovation at the project level: Which practices do firms use across the different project activities? How openly do they share knowledge, if at all? Have firms matured and started to manage open innovation projects in a more formalized and structured way?

About the Study
This study asked large, global companies about their open innovation practices through a 17-question survey, which extends our prior survey in order to allow for comparability of results. Each question comprised multiple items. As in our 2014 study, the survey questions moved beyond the two most widely used measures of openness—breadth (the number of sources accessed) and depth (the intensity of interaction with a single source)—to ask about the role of different open innovation practices, this time at the project level as well as the firm level. Further, we introduced additional measures to allow a more fine-grained analysis of the state of openness at the project level.

The survey was organized in two sections; the first section asked about the adoption and management of open innovation at the firm level (6 questions), and the second focused on the project level (11 questions). In the first section, we asked about the adoption of open innovation across the organization, the resources dedicated to it, and the characteristics of the firm’s open innovation portfolio. In the second section, we asked each respondent to select two projects within his or her company, one successful and one unsuccessful, and respond to the questions with those projects in mind. The questions asked about the external sources involved (for instance, customers, suppliers), the use of particular open innovation practices, the degree of knowledge sharing and intellectual property (IP) control involved, and the degree of formalization of project activities, for instance, through formal routines and performance metrics. We also asked about the organizational unit to which the project teams reported.

To ensure a robust survey design, we drew upon the research on open innovation and enriched it with literature on coordination and knowledge sharing in interorganizational relationships (for instance, Chesbrough and Bogers 2014; Felin and Zenger 2014; Jarvenpaa and Majchrzak 2016; Kirsch 1996; Laursen and Salter 2006). Where possible, we used constructs whose reliability has already been empirically tested. We also structured questions to elicit behavioral rather than perceptual responses, to increase the quality of responses. For instance, rather than asking which kinds of partners were perceived as most important, we asked how much time team members spent interacting with particular partners. Where perceptual responses could not be avoided, we used the established seven-point Likert scale.

We sent the survey to senior executives (Chief Executive Officers, Chief Technology Officers) at 2,445 large, market-listed firms in the United States, Canada, and Europe; all firms in the sample had annual revenues of at least $250 million and at least 1,000 employees. We received 121 usable firm-level responses (73 from European firms, creating a slight response bias from Europe) and 104 usable project-level responses—57 successful and 47 unsuccessful projects. Of the 104 project-level responses, 90 represented success/failure pairs, for 45 pairs. This sample size is comparable to the sample size in the 2014 study. To our knowledge, this is one of the largest project-level surveys to include both successful and unsuccessful cases.

Data collection took place between December 2014 and August 2015. We followed up with complementary qualitative interviews with some study participants to refine our understanding of the project-level results. Some of these interviews led to detailed case analyses (see, for example, Narsalay et al. 2017). Preliminary findings were presented in the opening remarks at the World Open Innovation Conference in December 2015 (Bagherzadeh and Brunswicker 2015).

Results
A primary motive for this study was to continue the study of the adoption of open innovation in large firms begun in our previous survey (Chesbrough and Brunswicker 2014). The findings from this latest survey clearly indicate that open innovation continues to be widely adopted—about 78 percent of respondents reported that their firms practiced open innovation, roughly the same level of adoption found in 2014. More than 50 percent of those firms practicing open innovation adopted it as a strategy more than five years ago, a finding that suggests that open innovation remains quite durable as an innovation strategy. About 20 percent stated they started with open innovation even before 2003, the year Chesbrough published the book that labeled the paradigm.
We also asked about firms that may have experimented with open innovation and then abandoned it. In our 2014 survey, no respondents reported that their firms had abandoned open innovation. This time, 2.5 percent of respondents reported that their firms had practiced open innovation at some point and abandoned it. When asked to choose the reasons for abandoning open innovation from a list of six potential motivations discussed in the literature (for example, see Chesbrough and Brunswicker 2013), respondents most frequently chose a “lack of required organizational structure,” followed by “no perceived benefits,” “too risky for assets and IP,” “too difficult to manage,” “lack of management capabilities,” and “too expensive.” This finding clearly indicates that open innovation does not work for every firm and suggests that difficulties organizing for it may lead to frustration and ultimately the abandonment of the open innovation effort.

We also sought to establish the level of strategic support for open innovation among those firms actively engaged in it by asking about two indicators: the percent of total innovation expenditures devoted to open innovation efforts and the number of full-time roles dedicated to open innovation. Both of these measures revealed solid investment in open innovation across the sample. More than 42 percent of responding firms indicated that they had invested more than 10 percent of their innovation expenditures in open innovation in the year prior to the survey (Figure 1, left). Even more encouragingly, a large proportion of the sample reported having full-time employees dedicated to open innovation. More than 50 percent of responding firms had at least 5 full-time employees working on open innovation in the year before the survey; 15 percent had more than 30 (Figure 1, right).

We also asked about changes in expenditures, as a way to assess growth since our last survey. More than 60 percent of respondents indicated that their firms had increased financial support for open innovation in the last two years. For 20 percent of participating firms, the increase was greater than 50 percent, indicating rapid growth in the implementation of open innovation in these firms (Figure 2). Overall, these results confirm that firms are increasing financial support and are allocating more full-time resources to open innovation. This finding suggests that firms increasingly recognize the strategic value of open innovation. However, the expenditures for open innovation are still low relative to other strategic efforts—the median of expenditures for open innovation is 10 percent of total expenditures for innovation, which typically make up only a small portion of large firms’ overall strategic investment.

Firms typically implement strategic efforts, including those directed at open innovation, through policies and...
programs at the firm level. At a more operational level, they make use of open innovation to define and solve particular innovation problems. Thus, we examined how firms in our sample both implemented strategic approaches to open innovation at the firm level and implemented open innovation at the project level, in both successful and unsuccessful projects.

**Firm-Level Results: Strategic Approaches**

Following the logic of our prior study, our analysis defined open innovation along two dimensions: the directional flow of knowledge and the compensation associated with the knowledge flow. Open innovation may focus on knowledge flows in either direction, outside-in (or inbound)—that is, flows from external parties into the firm’s innovation pipeline—or inside-out (outbound)—flows out of the firm to external partners (Chesbrough 2003). Those flows may be pecuniary—generating financial compensation—or nonpecuniary (Dahlander and Gann 2010). A firm’s approach to open innovation is reflected in its innovation project portfolio, which comprises all of the innovation projects within the firm or business unit. In the firm-level section of the survey, we sought to explore the nature of this portfolio by asking about the percentage of portfolios comprising inbound and outbound innovation, and then asking about pecuniary versus nonpecuniary knowledge flows. In the discussion that follows, we report mean values.

Data from the 2014 survey indicated that large firms are typically net takers of knowledge: they take in substantially more free knowledge than they release to the outside. We explored this pattern further in the current study, measuring free inflows of knowledge by asking respondents about the share of projects in their portfolios in which they shared internal knowledge with outside parties for free; in other words, we asked about nonpecuniary outbound knowledge flows. Respondents indicated that, on average, 15 percent of their portfolio comprised these kinds of knowledge exchange (Figure 3). On the other hand, free inbound flows—flows in which the firm took in knowledge for free—represented 31 percent of firms’ portfolios, on average. By contrast, pecuniary inbound flows were represented in 34 percent of portfolios and nonpecuniary outbound flows comprised just 15 percent of portfolios. In other words, pecuniary and nonpecuniary inbound flows are roughly equally prevalent, while pecuniary outbound flows far outweigh nonpecuniary outbound flows. These data confirm our earlier finding of net taking among large firms: these firms are generally more willing to receive external knowledge for free than they are to make their own knowledge available to others for free.

Another type of outbound knowledge flow that we sought to explore is IP revealing, or colloquially, open source, an approach in which firms waive all legal control rights over intellectual property (Von Hippel and Von Krogh 2006). IP revealing contrasts with IP-controlled outbound open innovation, which takes place via mechanisms such as licensing or patent selling. We collected data on both types of knowledge sharing by asking about the proportion of projects in which respondents’ waived all IP rights. The mean was 8 percent. (It is worth noting that

![FIGURE 3. Use of inbound and outbound open innovation, as % of portfolio](image-url)
the data are skewed to the lower end of the scale, with the first quartile at 0 percent, the median at 1 percent, and the third quartile at 20 percent.) In contrast, the mean share of projects in which firms maintained control rights was 36 percent. It is worth noting that nonpecuniary flows can occur without the firm waiving IP rights; for instance, the firm can provide free usage rights but retain IP control.

Taken together, these findings suggest that both inbound and outbound open innovation are practiced relatively frequently, and even more so when firms can retain control of IP. When they do engage in outbound open innovation, firms tend to assert some degree of IP control. Despite the rising interest in open source in the broader discourse on open innovation, the uptake of open source practices among large firms continues to present difficulties. One of our post-survey interviewees, a senior executive at HP, underscored this issue: “One of the challenges in Open Innovation right now in our organization is to figure out how we can work with open source.” Open source can be a very successful strategy, but only in a small number of cases. Future work should examine in more detail the particularities of IP control, and its role in success, in outbound open innovation.

**Project-Level Results: Managing Knowledge Flows**

Many important decisions regarding open innovation are made at the project level. One of the most important relates to the question of which type of open innovation to choose to manage the knowledge flows at different stages of problem formulation and solution development. Typically, there are both inflows and outflows as a project progresses (Chesbrough and Bogers 2014); open innovation is rarely a one-way street. This reality complicates the management of open innovation projects and makes the decision about how to govern open innovation both critical and complex.

There are multiple governance modes for managing open innovation at the project level. According to existing theory, we can distinguish four major modes using two dimensions for classification: (1) Bilateral versus multi-actor and (2) Transactional versus collaborative (Bagherzadeh and Brunswicker 2015; Chesbrough and Brunswicker 2014; Felin and Zenger 2009, 2014). Each mode encompasses a particular set of practices and is associated with specific benefits and risks (Table 1). For example, running an innovation contest, a practice that falls into the multi-actor/transactional governance mode, gives access to a diverse pool of knowledge but creates challenges in terms of knowledge protection and lack of participation.

In the survey, we asked respondents to think of a specific innovation project and select the practices they used to manage open innovation in that project. Since practices can be used in combination, we allowed respondents to select multiple practices for a single project. We also asked them to distinguish where in the project the different practices were used: the problem definition stage, in which the team defines the problem and the goal, or the solution development stage, in which the team designs and tests the actual technical solution.

### Table 1. Overview of open innovation practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>Description</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communities and professional networks</td>
<td>Firm’s employees participate in open communities governed by rules and guidelines established by the community rather than the firm (e.g., an open-source community). Community members pursue a community-focused, rather than a firm-focused, R&amp;D goal. Members collaborate and share knowledge and resources within the community to achieve this goal.</td>
<td>Multi-actor/ collaborative</td>
</tr>
<tr>
<td>Firm-sponsored open innovation communities</td>
<td>External parties are invited to participate in the firm’s open innovation efforts; the firm designs and implements rules for participation.</td>
<td>Multi-actor/ collaborative</td>
</tr>
<tr>
<td>Informal networking</td>
<td>Firm’s employees participate in networking organizations (e.g., at conferences or events) to access external knowledge.</td>
<td>Multi-actor/ transactional</td>
</tr>
<tr>
<td>Open innovation intermediaries</td>
<td>Intermediary organizations specializing in open innovation are contracted to act as intermediaries between the firm, as searcher, and solvers who have potential solutions. Solvers typically do not collaborate or share knowledge with each other; they compete to provide the best solution in return for compensation.</td>
<td>Multi-actor/ transactional</td>
</tr>
<tr>
<td>Innovation contests and tournaments</td>
<td>A large number of participants (individuals, teams, or organizations) are invited to offer solutions in a competitive process. Participants compete rather than collaborate; winners are compensated financially and/or in other ways.</td>
<td>Multi-actor/ collaborative</td>
</tr>
<tr>
<td>Bilateral partnerships</td>
<td>Collaborative relationship in which two parties jointly develop a solution for a joint innovation problem through mutual knowledge exchange. Trust guides the collaboration.</td>
<td>Bilateral/ collaborative</td>
</tr>
<tr>
<td>Bilateral contracts</td>
<td>Contractual relationship in which two parties establish a transactional relationship for knowledge exchange guided by a legal contract that defines formal structures for knowledge sharing, e.g., licensing of intellectual property rights (trademarks or patents).</td>
<td>Bilateral/ transactional</td>
</tr>
</tbody>
</table>
Open innovation contests are largely insufficient as a stand-alone practice.

The most common practices differed across project phases (Figure 4). In the definition stage, informal networking (57 percent), bilateral contracts (47 percent), and collaborative partnerships (35 percent) were the most frequently used practices; all multi-actor practices ranked lower. Open innovation intermediaries and innovation contests were used in only 12 percent and 6 percent, respectively, of projects. Clearly, when defining the problem, firms frequently make use of practices that build on trust or establish clear contractual frameworks to manage uncertainty and ambiguity.

In the solution development stage, bilateral licensing contracts (71 percent), informal networking (56 percent), and collaborative partnerships (51 percent) are the most frequently used practices. The firms in our sample made only limited use of the power of the crowd for solution development—innovation contests were used during solution development in just 12 percent of projects. This is somewhat surprising given the enthusiastic discussion about crowds and contests among open innovation scholars (see, for example, Afuah and Tucci 2012; Boudreau and Lakhani 2013). However, our follow-up interviews provided a more nuanced understanding. Interviewees indicated that open innovation contests are largely insufficient as a stand-alone practice because the external knowledge received is incomplete. Firms that use innovation contests or open innovation intermediaries typically combine that activity with other practices to produce a result that actually gets to market. For example, Bosch used innovation intermediary NineSigma to run an innovation contest (Brunswicker et al. 2016, Narsalay et al. 2017), but to actually realize the benefits from the solutions yielded by the contest, the company established partnerships with selected solvers to refine their solutions to better fit the firm’s business model.

We further explored the degree of openness at the project level, asking managers about how they both shared knowledge in the early stage and controlled use in the late stage through legal control rights (for instance, through patents). Open innovation creates an inherent tension between sharing knowledge to create an incentive for external parties to engage and retaining sufficient control over knowledge to benefit from it. Sharing and protecting need not be binary concepts—firms do not have to choose between sharing all knowledge or giving up control completely. Rather, they must be selective in deciding where and how to share knowledge and whether and how to retain legal control of it.

To learn more about this tension and how managers address it at the project level, we asked respondents to report the project’s approach to knowledge sharing in the problem definition stage, and to legal control in the solution development stage. In the definition phase, respondents reported that most projects shared both market and technological knowledge with involved parties (Figure 5, left). However, firms did not completely open up; rather, they shared selectively. In 50 percent of the projects respondents told us about, firms only selectively shared technological knowledge. The importance of a selective approach becomes even more evident in the solution development stage (Figure 5, right). In 46 percent of the projects, firms chose a selective approach, waiving control rights for particular technological areas. Only in 15 percent of the projects did the firm completely waive all legal control rights over new knowledge (in the sense of open source).

These project-level data refine our findings at the firm level. Firms selectively share knowledge in the definition stage. In the solution development stage, they are even more careful, rarely waiving all control rights over emerging knowledge. Instead, they retain some control over certain usage and application areas. Such selective strategies are important to create incentives for external partners positioned upstream in the value chain (as smaller firms often are), as it
offers alternative paths to market. However, there is much to learn about the challenges of realizing such selective strategies.

Preferred Partners and Sources for Open Innovation
A number of firm-level surveys have collected data about sources and partners for open innovation at the firm level (Laursen and Salter 2006). The project-level data we collected provide more granular insights into how firms actually implement open innovation than these previous studies can, as we ask the respondents to assess how often internal project teams actually engaged with external partners across the two phases of innovation—problem definition and solution development. Our data show that many projects—75 percent—involved customers more than any other source; this number holds across both stages (Figure 6). Suppliers and universities were involved in more than half the projects, as were entrepreneurs and startups. Unsurprisingly, competitors ranked last as preferred sources or partners in both stages.

To provide a more fine-grained picture of the actual intensity of involvement, we asked about how much time project teams spent interacting with each source. When the amount of time spent is assessed, customers no longer dominate (Figure 7). Surprisingly, project teams spent quite a lot of time with entrepreneurs and startups—about 20 percent of their time in the definition stage, followed by customers (15 percent) and suppliers and universities (both 12.5 percent). In the solution stage, interactions with entrepreneurs are also quite intense (25 percent of time), followed by suppliers (20 percent) and customers (10 percent). Interaction with competitors is limited; on average, project teams spend about 7.5 percent of their time with competitors in the definition stage and about 2.5 percent during solution development. This is not surprising, given the risk of loss of competitive advantage in interacting with competitors. These results enrich findings from our prior study (Chesbrough and Brunswicker 2014); although these new data highlight the importance of the involvement of customers, they also show that large firms spend more time with entrepreneurs and suppliers to create value for their R&D pipeline.

Formalizing the Management of Open Innovation
Open innovation requires project teams to accomplish a complex task: they must manage the typical difficulties associated with any kind of innovation along with the added complications introduced by flows of knowledge across organizational boundaries (Felin and Zenger 2014; Kirsch 1996). Some formalization of project activities, in the sense of recorded routines and clearly specified performance metrics, may help teams to better channel their efforts toward success. Our last study showed that the management of open innovation lacked such
formalized approaches (Chesbrough and Brunswicker 2013). In the current survey, two years later, we sought to explore whether this had changed.

In addressing this question, we focused on two aspects of formalization: process formalization (for instance, established sequences of activities documented in manuals) and outcome formalization (defined performance targets and metrics). All the projects described by respondents used at least some level of process formalization during the definition stage (mean = 4 on a scale of 1 = no formalization to 7 = very high formalization). The average degree of formalization was slightly higher (mean of 4.5) in solution development. Results were similar for outcome formalization, with a moderate level of outcome control in both stages (mean = 4 and 4.5 in problem definition and solution development, respectively, on a scale of 1 = no control to 7 = very high control).

We also wanted to understand what metrics firms are using to assess the success of open innovation efforts. When presented with a list of potential project-level metrics, respondents most frequently selected “budget invested in a project” (84 percent) and the “number of technological opportunities introduced” (82 percent) as the leading metrics for open innovation (Figure 8). These were closely followed by measures focused on market reputation (74 percent) and customer satisfaction (74 percent). Costs at the end of the project were chosen the least (51 percent).

Taken together, these findings demonstrate that firms have matured in their implementation of open innovation. They are formalizing the process and measuring performance against defined metrics. Further, the most frequently used metrics focus on input measures (project budget) as well as outcome measures (technological opportunities and reputation), suggesting that companies have found ways to measure benefits as well as costs.

**Success Versus Failure Cases—Some Exploratory Insights**

To allow for preliminary analyses of success and failure cases, we asked respondents to tell us about two projects—one success and one failure. Exploratory comparative analyses on the two sets of projects—57 successful projects and 47 unsuccessful projects, with 45 matched pairs—yielded insights related to IP control, formalization, and the role of top management support.

First, we explored potential differences in terms of technological knowledge sharing and IP control. In the definition stage, 56 percent of successful projects engaged in selective sharing (compared to 41 percent among unsuccessful projects), and only 11 percent did not share any knowledge, compared to 22 percent among unsuccessful ones (Figure 9, left). We find a similar pattern for IP control during the solution development phase, with more selective strategies used in successful projects. Among successful projects,
only 31 percent used full IP control, compared to 48 percent among unsuccessful ones. By contrast, 53 percent of the successful projects used selective IP control strategies compared to only 37 percent of unsuccessful ones (Figure 9, right). This finding suggests that selective strategies for technological knowledge sharing and IP control are frequently used in both the definition and the solution development stages of successful projects. Being purposively selective may be important for a project’s success; future work should explore further the role of purposive selective strategies for knowledge sharing and IP control in the success of open innovation projects.

We also explored success and failure cases with respect to the degree of formalization implemented. These results suggest that successful projects engage in a high degree of formalization in both stages (Figure 10). For example, in solution development, respondents reported a mean level of process formalization of 4.6 for successful projects, compared to 4.1 for unsuccessful ones (on a scale of 1 = no formalization and 7 = high formalization). The mean degree of outcome control for solution development was 4.5 for successful projects, compared to 4.2 for unsuccessful ones. Given this descriptive insight, future work should further explore the role of formalization for project success.

Finally, our results also point to the role of top management support in open innovation success. We asked respondents to select the organizational unit to which the project teams reported to. Among the successful projects, 35 percent reported directly to the board of senior executives with financial authority and budget control, compared to only 22 percent among unsuccessful projects (Figure 11). These results are only descriptive and we are not arguing for statistical significance, but the data hint at the importance of support from the senior executive team. Projects that have to report to the board may benefit from this requirement in any number of ways—it may be that the simple reality of having to report to the board pushes team members to work harder. It is equally likely, however, that projects might be successful because of strategic mentoring from board members.
Analyses provided by other project-level studies (for instance, an obsession with legal IP control. These findings enrich the tension processes and outcome measures rather than nurturing companies might consider formalizing open innov.

The tension between knowledge sharing and knowledge purposive selectivity will require conscious effort to balance. An important theme in this study, although this kind of project level. Being selective rather than closed by default is an important theme in this study, although this kind of purposive selectivity will require conscious effort to balance the tension between knowledge sharing and knowledge protection (Jarvenpaa and Maehrzak 2016). To tackle this tension, companies might consider formalizing open innovation processes and outcome measures rather than nurturing an obsession with legal IP control. These findings enrich the analyses provided by other project-level studies (for instance, Du, Leten, and Vanhaverbeke 2014).

We hope that future, more rigorous research will build upon these insights and examine in more detail how firms can purposively and selectively manage knowledge flows through organizational processes and routines as well as legal mechanisms.

**References**


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