Coase Meets the Cloud:

How and When Can Outsourcing IT Improve Organizational Performance?

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Abstract

This paper uses interviews with cloud providers and their customers to examine the realized and potential benefits of cloud-computing adoption on productivity and business processes in organizations. Although the diffusion of cloud computing is relatively early in its expected life cycle, organizations have already begun to experience improvements from the information-gathering and communication-enhancing attributes of the cloud. In particular, organizations have observed that the cloud can reduce the cost of gathering given information; it can allow given information to be communicated more quickly and accurately; and it can allow new information, including from new participants, to be gathered and communicated. There are also indications that the cloud is beginning to enable even more substantive changes in organizations, such as empowering employees lower in corporate hierarchies to make decisions and providing the capability to ask questions and undertake projects that were prohibitively expensive in the past. Certain attributes of the cloud that distinguish it from prior IT solutions may enable it to overcome organizational, cultural, political, and contractual impediments that sometimes beset pre-cloud IT services.

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I. Introduction

The outsourcing of firms' information technology (IT) activities via cloud computing could enable fundamental improvements in organizational design and performance. Indeed, some have compared the cloud's potential to the changes wrought when firms switched from supplying their own electric power to purchasing power from the grid.[3]

Economic thought on whether it is more efficient for a firm to undertake an activity itself or to outsource the activity began with Ronald Coase's seminal work in 1937. Coase and later researchers argued that the ability of a firm to purchase goods or services efficiently in the marketplace (i.e., to procure externally an input to the firm's main production activity) is limited by the existence of *transaction costs* that may arise when a firm interacts with an outside party. These transaction costs from outsourcing are incremental to the purchase price of the goods or services; they include search and information costs and costs of preparing, implementing, and monitoring contracts with suppliers.[4]

Related research also analyzed the costs of performing an activity within the firm, which include not only production costs but also *organization costs* from turf battles and other political behaviors inside the firm. For example, it is common to view appropriate outsourcing as way to enhance a firm's focus on what it does best (its main production activity), and one of the sources of this enhanced focus may be the reduction of lobbying and other influence activities by non-core parts of the firm that, absent outsourcing, would conduct various non-core activities.[5]

In short, whether it is efficient for a firm to procure an input externally depends not only on the relative production costs if an outside or inside party produces the input but also on the relative transaction versus organization costs. In the case of the cloud (as with electric power), strong economies of scale may make production costs significantly lower if an external cloud provider supplies IT services to many customers than if a single firm attempts to do so for itself. For most of this paper, therefore, we assume that this production-cost advantage of outsourcing IT to the cloud swamps the comparison of transaction and organization costs. Accordingly, we focus primarily on the improvements in productivity and organization that have been and may be

[3] See Carr (2008).

[4] See Tadelis and Williamson (2012) for a survey of such "transaction-cost economics."

[5] See Gibbons, Matouschek, and Roberts (2012) for a survey on power, politics, authority, and influence in organizational decision-making.

enabled by the cloud, although we return to the issues of transaction and organization costs towards the end of the paper.

More specifically, the main contribution of this paper is to explore the productivity improvements experienced by several early adopters of cloud computing. To do so, we conducted interviews with personnel at cloud providers and their customers. The interviews were arranged by Google and hence focus on how these customers use Google products. Given the composition of our sample, we clearly cannot analyze the typical or average effect of outsourcing to the cloud. Instead, these cases suggest what *might* be true more broadly. It would be fascinating to conduct further interviews with (a) customers of other cloud providers, and (b) firms that have thus far decided not to outsource their IT to the cloud.

Although the diffusion of cloud computing is relatively early in its expected life cycle, organizations have already begun to experience productivity improvements from the information-gathering and communication-enhancing attributes of the cloud. In particular, organizations have found that the cloud can reduce the cost of gathering given information; it can allow given information to be communicated more quickly and accurately; and it can allow new information, sometimes from new participants, to be gathered and communicated.

There are also indications that the cloud is beginning to enable even more substantive changes in organizations, such as empowering employees lower in corporate hierarchies to make decisions and providing the capability to ask questions and undertake projects that were prohibitively expensive in the past. At the same time, however, there are hints that the organizational structures and cultures of some firms may prevent them from fully realizing the productivity benefits that the cloud may offer. For example, interviewees noted that "innovation is not installed" and "people are harder than technology" (and no less important)—themes that echo the academic literature on previous episodes of IT adoption, which emphasized the need for a firm to possess or implement complementary organizational practices that reinforce IT's benefits.[6]

The paper is organized as follows. Section II provides an overview of cloud-computing technology and a framework for evaluating how the cloud could improve productivity in organizations. Section III provides a series of brief case studies that illustrate how organizations in diverse industries are benefiting from the cloud today. Section IV considers both how

[6] See Section IV for a brief review of and citations to this literature.

organizations might use the cloud in the future and what impediments firms may encounter (both transaction costs and organization costs) in attempting to get the most out of the cloud. Finally, we conclude in Section V with a discussion of how the cloud differs from prior episodes of IT use and why the cloud might build on or surpass these past efforts.

II. Overview of Cloud Computing and a Framework for Assessing its Potential to Improve Productivity in Organizations

In this section, we discuss the characteristics that define cloud computing and identify the categories of cloud-computing services that providers currently offer. We then provide a framework for thinking about how organizations could use the cloud as a platform to increase productivity. In particular, we focus on the cloud's ability to enhance information gathering and lower communication costs within organizations, resulting in access to more and better information, a faster pace of communication, and possibly involvement from more participants in decision-making processes. In some cases, the cloud can also amplify a culture of worker empowerment, thereby creating new decisions or work processes that were impossible or prohibitively costly before the cloud.

A. Characteristics and categories of cloud-computing services

Despite the immense coverage of the emergence of the cloud in the business press, popular press, and, more recently, the academic literature, the fundamental idea of centralized computing conducted over a network is not new. Thought leaders envisioned such a computing model as far back as the 1950s.[7] What is innovative, however, is the introduction of particular cloud products that have the potential to change the way people work and interact in organizations.

In this paper, we will abide by the definition of cloud computing proposed by the National Institute of Standards and Technology, which defines it as "a model enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."[8]

[7] See, for example, the discussion in Ryan, Merchant, and Falvey (2011).

[8] National Institute of Standards and Technology (2011, p. 2).

Breaking this definition into its constituent pieces, the important characteristics of cloud computing with respect to employees at adopting firms are the following: "broad network access" (employees can access cloud services through a browser on any number of devices, including desktops, laptops, mobile phones, and tablets); "rapid elasticity" and "on-demand self-service" (employees and firms can scale use up or down at will without interacting with the cloud provider); "measured service" (firms pay for services based on usage rather than making upfront commitments for hardware and software); and "resource pooling" (providers pool computing resources to serve multiple customers, with one consequence being that adopting firms may not know the exact location of the computing resources that they are using).[9] Consistent with the resource-pooling aspect of this definition, we focus on the "multi-tenant" or "public" cloud, in which the cloud provider hosts infrastructure that may be shared by several customers. Alternatively, in a "private" cloud model, infrastructure is provided for use by a single customer, such as when an organization purchases hardware and software in order to maintain its IT services in-house.

There are three categories of service models offered by cloud providers.[10] The most comprehensive cloud offerings are reflected in the "Software-as-a-Service" (SaaS) model, in which the user accesses the provider's applications running on the provider's cloud infrastructure. These applications are consumed through a web browser or a program interface. One of the earliest and most successful SaaS providers is Salesforce.com. While Salesforce.com historically has focused on customer relationship management (CRM) software, it has recently begun to offer broader collaboration tools such as its Chatter application, an enterprise social-networking platform that facilitates interaction and information sharing within and between organizations. Office productivity software, such as Google Apps—which includes web-based e-mail (Gmail) and text editing (Google Docs), among other tools in the suite—is another example of SaaS.

The case studies of cloud adoption that we discuss below focus primarily on use of SaaS products. The two other cloud service models are "Infrastructure-as-a-Service" (IaaS), in which

[9] Information Technology Advisor Committee (2011, pp. 4-5).

[10] This taxonomy of service models is widely discussed. See, for example, Information Technology Advisor Committee (2011), National Institute of Standards and Technology (2011), McAfee (2011), and Morgan Stanley Research (2011).

providers offer use of computing resources, such as hardware for processing, storage, and networks, and "Platform-as-a-Service" (PaaS), which includes the underlying infrastructure and software development technologies upon which users can build their own applications.

B. Framework for assessing the effects of the cloud on productivity in organizations

In this section, we define key concepts and preview how the cloud may enable enhanced productivity by improving information gathering and communication (and, hence, adaptation, coordination, and collaboration).

In some circumstances, it is efficient for an individual with local information to be granted the authority to make a decision with respect to that information, rather than having to communicate that information (usually imperfectly) to her manager to make a decision. That is, it can be advantageous for local entities to respond to their local circumstances because that allows for *adaptation* to changes in their environment.[11] For example, an engineer with expertise in automobile-braking systems may be better positioned than her project manager to decide whether an innovation in braking technology should be adopted: the manager may lack the expertise about brake systems, the information about the technological innovation, or both.

In many organizations, however, the advantage of local decision-making is tempered by the fact that decisions interact with each other. Indeed, such interactions are often an important reason that different people are in one organization together rather than in separate organizations; see Roberts (2004), for example. The result of such interactions is that *coordination* of decisions within an organization is also valuable.[12]

One way that coordination can be achieved is by standardizing decisions, so that each part of the organization knows in advance what the others will be doing. Of course, such standardization relinquishes the value of adaptation, creating an organization that runs on rules rather than discretion. To achieve both coordination and adaptation, the organization needs *communication*—the sharing of local information and local adaptations. In terms of the brake-system example, because adoption of a particular braking technology would interact with other elements of automobile design, it may be efficient for the engineer to communicate her opinion

[11] This outcome also presumes, of course, that the individual is appropriately trained and has sufficient judgment to warrant such discretion.

[12] Such coordination may also be necessary *between* organizations, such as in multiple firms operating in a supply relationship or a joint venture.

to the project manager, who would then make a decision in the context of the overall car design, rather than the engineer making the decision at the local level.

In addition to communication, the promise of the cloud for *collaboration* has generated substantial interest.[13] In this paper, we do not draw a strong distinction between collaboration and communication. That is, for most of this paper we view collaboration as a group of individuals working together to accomplish a common task by communicating with each other—sharing information, ideas, and opinions. We note in passing, however, that communication, coordination, and collaboration are sometimes complicated by conflicts of interests; the resulting lobbying, influence, and politics are among the organization costs we discuss briefly in Section IV.

Having articulated these key concepts, we next preview how the cloud may enable enhanced productivity by improving information gathering and communication. An improvement in information gathering can be viewed as a reduction in the cost of locating given information or, more generally, as access to a broader and richer set of information than was previously available. Similarly, an improvement in communication can be thought of as a simple cost reduction or, more generally, as a combination of easier, faster, and more precise communication.

In an organization that empowers employees to take initiative and make decisions, improvements in information-gathering can make local decision-making more effective. Likewise, in an organization that emphasizes teamwork, improvements in communication can facilitate enhanced collaboration. In both of these cases, the cloud may simply enhance the effectiveness with which existing work is performed (e.g., how quickly, how accurately, or how easily), without substantially changing the underlying work processes or relationships within the organization. As one concrete example of such collaboration, use of the cloud to store and edit a document means that a single master copy of the document always exists: difficulties associated with version control are eliminated; track changes and document restore are built into the software.[14]

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[13] A paper by Forrester Consulting (2010) surveyed adopters of Google Apps and identified several "collaboration-specific benefits," including "faster document revision reconciliation, timely project tracking information, improved ability to quickly incorporate feedback, improved meeting efficiency, efficient companywide information distribution, and efficient sharing and processing of feedback."

[14] See Varian (2010).

It is also possible that in certain circumstances and in organizations with certain cultures the cloud may fundamentally transform how work is structured. Such transformation may include changes in organizational form, decision-making, the assignment of job responsibilities, or the creation of new decisions and processes. Although it appears to be too early in the history of the cloud to observe widespread transformations of this kind, there are indications that some early adopters are realizing benefits from the cloud that go beyond conducting existing work practices more effectively.

Finally, there are at least three important limits to our discussion of the cloud's effects on productivity in organizations. First, we do not address direct cost savings that may arise from using cloud computing as an exact replacement for in-house IT services—a cost saving that would typically appear on an IT expense line item on an income statement.[15] Instead, we focus on improvements in the set of outputs that can be produced from a fixed set of inputs, rather than reductions in the costs of those inputs.

Second, we do not consider new products that could not be produced or delivered without the cloud. For example, many news organizations (including one discussed below) now offer both interactive content and opportunities for readers to comment, both of which might be greatly facilitated by the cloud. As with direct reductions in the IT expense item, the creation of new products (and companies and industries) that could not exist without the cloud is potentially very interesting, but well beyond the scope of this paper.

Last, we discuss only information, not knowledge. Knowledge is richer and deeper than information. Davenport and Prusak (1998) define knowledge as "... a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information." Knowledge sharing is likely more difficult than information sharing, given that knowledge cannot be codified as simply as information can be. It may be that some aspects of the cloud improve knowledge sharing as well as information sharing, but we focus on the latter as both a simpler place to begin the discussion and the locus of most of the activities we heard about in interviews.

[15] McAfee (2012) measures the direct cost savings associated with moving to the cloud for small- and medium-sized businesses.

III. How Are Organizations Using the Cloud Today?

To assess whether, and to what extent, firms are improving organizational performance through the use of the cloud, we interviewed several cloud providers and early adopters of cloud products. Collectively, these interviews indicated that firms are already starting to experience productivity improvements, despite using the cloud for only a limited period of time. The initial motivation of many of these firms to adopt the cloud was to achieve direct cost savings compared to maintaining in-house IT systems. Interestingly, while interviewees observed that these direct cost savings have been achieved, they are more excited about the unanticipated ways in which the cloud has facilitated information gathering and communication within their organizations, ultimately resulting in increased productivity beyond the savings in IT expense.

Many organizational improvements resulting from use of the cloud today can be grouped into two broad and related categories: (1) the cloud allows for the delivery of the same information into the same decision process (e.g., the same decision maker), producing the same organizational outcome, but does it all faster and more efficiently than in the absence of the cloud, and (2) the cloud allows for the delivery of additional and better information (often from a wider array of people) into the same decision process as before the cloud, which may allow more parties to influence outcomes. While these outcomes do not transform underlying work processes, they can result in meaningful changes in productivity. In this section, we first discuss several common ways in which adopters are using the cloud. We then provide six specific case studies illustrating how a diverse set of organizations is benefiting from the cloud. While we focus predominantly on the use of Google's products because this project granted us access to Google's customers, other providers' cloud products that lower information-gathering costs and enhance communication would likely have similar effects on organizational performance. Brief descriptions of the specific cloud-computing products that we discuss in this paper are provided in the Appendix.

Common Uses of the Cloud

Certain features of Google Apps were identified by all of the customers that we interviewed as increasing productivity. In particular, customers pointed to the benefits of both being able to have multiple users edit a document simultaneously and eliminating difficulties associated with version control. Customers observed that simultaneous editing accelerated the

drafting process. An interviewee at Ocado, an online grocery retailer, further noted that the use of Google Docs with Google Chat has allowed users to exchange information and provide feedback to each other instantaneously while drafting the document. The version control feature in Google Docs was also noted by customers as improving productivity. This feature eliminates any confusion about which document is the most up-to-date, improving the reliability of the information that is conveyed in the document and allowing users to make better-informed decisions.

Similar improvements stemming from version control were noted with respect to Google Spreadsheets. For example, at *Westword*, a weekly newspaper, editors are able to track the work performed by freelancers and the status of payment more easily. Prior to adoption of Google Apps, this exercise was performed through the exchange of e-mails with spreadsheet attachments, which often led to questions about which version of the spreadsheet was the latest. Use of a centralized spreadsheet shared by all authorized editors has eliminated such difficulties associated with version control. This example illustrates the ability of the cloud to facilitate faster and more accurate communication between employees than in the absence of the cloud.

Case Study #1 – Pure Energy Services[16]

Pure Energy Services ("Pure Energy") is an oil and gas provider headquartered in Alberta, Canada with operating units in both the U.S. and Canada. Pure Energy has approximately 1,500 employees, 90% of whom work remotely at one of its 30 field stations. Despite providing only minimal training on Google Apps, the technology has been rapidly adopted by employees, particularly those in its field teams. Pure Energy has noted three types of gains from its use of Google Apps: (1) more accurate and efficient consolidation and dissemination of information, (2) increased collaboration and a more effective relationship between IT users and the IT department, and (3) initial steps towards empowerment of field employees, who are starting to create faster, directed solutions to improve efficiency. We discuss each of these gains in turn.

The efficiency of information collection and dissemination at Pure Energy has improved as a result of using Google Apps. For example, in the past, it was an ongoing struggle to update

[16] Information in this case study is based on an interview with Zachary Curry, Pure Energy Service's Director of Information Systems and Technology, and the company's website (www.pure-energy.ca).

the safety procedure manuals used by the field teams given the nature of Pure Energy's operations and the decentralized business model that is common to all oil and gas service companies. This process was complicated by the fact that each field team had multiple copies of these documents on thumb drives or in physical binders. Now, with Google Drive, field team employees can remotely access the same version of these safety documents as well as upload new documents that become immediately accessible to other field units. Even when field sites do not have Internet access, administrators are able to sync new information to field station laptops on a weekly basis. Because the use of cloud products, such as Google Drive, are not location dependent, users, such as Pure Energy's field teams, can access these services outside of a traditional office from a variety of devices (including laptops and mobile phones). As a result, this technology improves individuals' information-gathering abilities, allowing them to make decisions more quickly than in the absence of the cloud.

The cloud has also transformed the relationship between the field teams and the IT department. Pre-cloud, the IT department's role was to handle complaints and push pre-selected applications to the field. Since Google Apps has been adopted, the field teams have developed a more collaborative relationship with the IT department. The field staff is less dependent on the IT department for tasks that can be handled easily in Google Apps, but at the same time is able to work with the IT department on extending functionality further than they could on their own. For example, after using Google Sites to set up employee schedules, field team members approached the IT department to develop a Google Apps Script that could automatically update employee schedules when certain changes were made on the Site. This example illustrates the greater level of collaboration between the IT departments and the field teams that has emerged that serves to improve the technical applications used by the field teams.

There are also indications that the cloud may be just beginning to generate changes that go beyond providing faster or better information into the same decision process. Pure Energy noted that there are a few key senior field managers who recognized the potential benefits of using Google Apps to empower field employees. These field managers realized that the cloud could help them take greater control of information and perform certain tasks more efficiently than they could with older technology. For example, field staff managers have created distribution lists using Google Groups that identify which client personnel should receive status updates at certain sites. If the client changes the personnel that it has on-site, the field manager

can change the distribution list so that status updates are sent only to the appropriate people. The use of Google Groups has given the field manager authority over who is included on a distribution list, a decision that had previously resided with the central office. Further, the use of a distribution list in this way is superior to the use of e-mail, where tracking which individuals should be sent status updates was cumbersome and often resulted in information being shared with the wrong people. While this is a modest example of employee empowerment, it indicates how the cloud can enable employees at the base of the corporate hierarchy to participate in decision-making to a greater degree.

Having used Google Apps for less than a year, Pure Energy envisions further gains from this technology in the future. One area that it expects to pursue is sharing information and coordinating directly with customers and other external parties through Google Apps. While Pure Energy is still exploring the controls that it needs to have in place to make sure that information is accessible only to appropriate parties, it is optimistic about the possibility of using Google Apps to work more effectively with outside entities.

Case Study #2 – Cadillac Fairview[17]

Cadillac Fairview, also based in Canada, is one of the largest investors, owners, and managers of commercial real estate in North America. Its current portfolio, which is valued at over $20 billion, includes 83 properties across North America. The core of Cadillac Fairview's business involves the buying, holding, and leasing operations of real estate. Since adopting Google Apps, Cadillac Fairview has realized improvements in information gathering and communication, as well as the ability to ask and answer questions that were prohibitively costly or time-sensitive before the cloud.

Cadillac Fairview's "deskless" employees have been among its quickest and most creative users of Google Apps and have employed the new technology to increase their productivity. Members of its maintenance staff, for example, have used Google Docs to save technical manuals, which they can share with other employees and access remotely from laptops or mobile phones. This ubiquitous access to information eliminates the need to transport physical manuals and reduces time spent locating necessary information.

[17] Information in this case study is based on an interview with Scot Adams, Cadillac Fairview's Senior Vice President for Operations & Technology, and the company's website (www.cadillacfairview.com).

Staff members with more traditional in-office roles have also employed Google Docs successfully. For example, the operations group has used Google Spreadsheets to collect information on holiday shopping hours from its different commercial properties, a process that takes only 1 ½ hours. Prior to adopting Google Apps, asking such a question required too much time and effort to collect useful and current data. The speed of communication experienced through Google Apps, however, has allowed Cadillac Fairview to start asking more helpful questions and collecting information more quickly.

Although Cadillac Fairview has realized gains through its use of Google Apps, the predominant culture and organizational structure of its core business have limited the need for transformational change. Cadillac Fairview describes its industry as traditional and notes that it has many long-standing ways of doing business and established forms of technology (such as software for enterprise resource planning written as far back as 1984). Despite these impediments, Cadillac Fairview has observed that cloud technologies have allowed its employees to be more productive and that these productivity gains may one day render some middle-man positions less relevant, leading to some degree of organizational change, even in this traditional industry.

Case Study #3 – Ocado[18]

Ocado, based in the UK, is the world's largest automated online grocery retailer, with delivery service covering more than 70% of UK households. Ocado describes its operations as a "spoke" model, where its central inventory is housed in one warehouse and then typically distributed by truck to several regional hubs before delivery to customers. Ocado's IT department—the company's biggest department—has developed a large amount of propriety software that integrates its various automated warehouse systems. Ocado views this software as a competitive advantage and the key to its market position. Ocado deployed Google Apps in late 2010 with the hope of cutting costs and improving productivity in these IT aspects of its business.

Since its adoption of Google Apps, Ocado has come to realize benefits from real-time communication and collaboration, especially through Google Docs and Google Chat. Products

[18] Information in this case study is based on an interview with Mark Bush, a Team Leader at Ocado, and the company's website (www.ocadogroup.com).

such as Google Chat have facilitated real-time, high-bandwidth communication when used in combination with Google Docs, making for richer and deeper collaboration within Ocado's IT department. For example, the IT department uses Google Docs and Google Chat when developing project-specification documents for new software, while the team responsible for creating mobile apps for customers combines Chat with Google Docs and Spreadsheets to manage its projects. Such real-time communication has the characteristic that it is conversational in nature: there is nearly instantaneous back-and-forth between participants. Ocado has also benefited from the ability to have multiple users edit a document simultaneously and the elimination of version control issues, as discussed above.

At this point in its adoption, Ocado has started to consider how additional benefits can be generated from Google Apps, such as exploiting the ability to collaborate directly with external parties. Ocado's primary concern with external information sharing at this time, however, is its inability to control proprietary information and audit the content, timing, and extent of information that is shared. Ocado is also considering how a roll-out of Google Apps to additional personnel in the company, such as drivers and warehouse pickers who do not currently use this technology, could lead to further productivity improvements.

Case Study #4 - Village Voice Media and Westword[19]

Village Voice Media owns 13 free, alternative, weekly newspapers published in cities throughout the U.S. These newspapers include *The Village Voice* in New York City, America's oldest and largest alternative weekly, and *Westword*, founded in 1977 and published in Denver, Colorado. *Westword*, like many of Village Voice Media's other weeklies, distributes its content through a website and a mobile application that are updated many times daily, in addition to publishing its weekly print edition. Village Voice Media adopted Gmail throughout the organization in November 2010. At that time, it also made other tools in Google Apps—such as Docs and Spreadsheets—available to employees, though the extent of usage of these apps was left up to each weekly.[20]

[19] Information in this case study is based on an interview with Nick Lucchesi, Senior Web Editor at Voice Media Group, and Jonathan Shikes, Managing Editor at *Westword*, and the companies' websites (http://www.villagevoice.com and http://www.westword.com).

[20] An exception is that Village Voice Media has created Google Spreadsheets that have been shared with editors at the weeklies that the editors can view or comment on, but not edit.

There are several ways in which writers and editors at *Westword* have used Google Apps. First, editors have used documents created and shared in Google Docs as a substitute for communicating with writers through e-mail. In particular, an editor can maintain a document that contains information on her writers' assignments, which the writers can access to update the status of their work. This process saves the editor the laborious task of maintaining e-mail exchanges with each of her writers. Instead, the editor can view one document that contains that current status of each or her writers' assignments—i.e., it is easier for the editor to gather information on the status of her writer's work using these tools. Second, as described above, the simultaneous editing and version control feature in Google Spreadsheets has been helpful in more efficiently completing budgeting exercises.

Despite Village Voice Media's adoption of Google Apps in these instances, there have been obstacles to more intense use of the tools, mainly stemming from the structure of decision rights at the company. For example, few writers use Google Docs to file their stories—i.e., writers do not create a Google Doc to write their stories, which they eventually share with their editor to finalize a story. The reluctance to use this process is a result of the "command and control" nature of the relationship between editors and writers. Once the writer has taken a story to a reasonable stopping point, editors need to have control of the document and "lock it down" to finalize it for publication. Interestingly, Google Docs gives document owners the ability to adjust the "permissions" that determine who has editing rights to a document, so that editors could in fact limit these permissions when a story needs to be locked down. This example illustrates the value of providing training to employees on the features of products such as Google Docs so that these products can be used to their full potential.

Case Study #5 – News International[21]

News International, a UK subsidiary of News Corporation, is a publishing company responsible for *The Times*, *The Sun*, and *The Sunday Times*. News International's core publishing business has used Google Apps to interact with readers, through surveys on Google Forms and through Google+, and to allow overseas staff to file reports and convey information remotely. A good example of the use of Google Apps at News International has been among

[21] Information in this case study is based on an interview with Ian McDonald, News International's Head of Infrastructure and Cloud, and the company's website (www.newsint.co.uk).

members of the IT department, which has realized productivity gains and found ways to function more efficiently. For example, the IT department now uses Google Docs as a way to keep track of topics and solutions discussed on its conference calls regarding incident management (such as a server going down). Now, whenever people join a call late or miss a call entirely, they can review the Google Doc to see what information they missed, rather than interrupt the call or take the time to follow up with someone afterward. Moreover, people who were not able to attend the call are able to review the document and propose solutions. This capability gives people who were previously unable to participate in the conference calls the ability to contribute possible solutions. In terms of the cloud's effect within the organization, News International expects improvements in productivity to continue to grow incrementally after the strong initial gains.

Case Study #6 – Best Buy and The Met Office Use Google App Engine[22]

Despite their disparate sizes, structures, and business models, Best Buy (a global technology retailer) and The Met Office (the U.K.'s national weather service) have both been successful using Google App Engine as a platform for the development of proprietary applications.[23] Best Buy switched to Google App Engine after realizing it needed to replace the previous development platform for its Giftag app, which allows users to create and share wish lists through e-mail and other social media platforms. The Met Office, meanwhile, chose App Engine as the platform for expanding the capability of its website to collect and disseminate millions of real-time weather reports across the globe.

Both organizations have cited scalability as the primary gain from using App Engine. With App Engine, updates or added features no longer need to be made manually and periods of heavy usage are managed seamlessly. This feature is particularly important for Best Buy during the holiday shopping season and for The Met Office during significant weather events. In the absence of a cloud platform like App Engine, companies would need to have additional servers in anticipation of high-usage periods.[24] These additional servers are expensive to maintain and require active monitoring of usage spikes in order to activate. Furthermore, the prospect of

[22] Information in this case study is based on prior Google case studies (https://cloud.google.com/files/BestBuy.pdf and https://cloud.google.com/files/MetOffice.pdf), and each organization's website (www.bestbuy.com and www.metoffice.gov.uk).

[23] Google App Engine is an example of a PaaS cloud product.

[24] The use of Google's computing infrastructure is included with the use of App Engine.

"down time" as a result of unavailable server capacity could result in significant losses of revenue and information.

App Engine has also enabled Best Buy and The Met Office to achieve productivity gains in the app development process. With fewer maintenance requirements and a faster coding environment, developers are now able to focus their time and resources on the development of newer and better apps instead of maintaining or tweaking existing ones. According to Best Buy, "Developing apps on Google App Engine takes one-fourth to one-tenth of the resources and one-fourth of the time compared to building something ourselves." The Met Office has also cited the benefit of integration with other Google products—such as Google Maps—in the development of its website. As a result of these benefits, both Best Buy and The Met Office plan to continue developing apps on App Engine.

IV. How Are Organizations Poised to Use the Cloud in the Future?

It takes time for any technology to diffuse and demonstrate observable value, and the cloud is no exception. One reason that it is necessary to allow a suitable amount of time to pass before value is observed is that technology adoption alone is often insufficient to generate substantial productivity improvements. Rather, an innovation such as the cloud may yield some benefits simply as a technology, but it may yield its largest benefits when combined with changes in organizational practices. If so, we expect that the future benefits of the cloud will go beyond those that we have documented above. In particular, one could imagine that the cloud could be associated with changes in the decision process, for example by flattening an organization and pushing decisions down to subordinates or by creating self-managed teams. Such outcomes may occur, for example, as the result of social-networking software encouraging communication and coordination across departments, limiting the need for centralized oversight to encourage communication. It is also possible that the cloud could enable the creation of new decisions or projects that were not possible or were too costly to undertake before.

We have seen hints of this type of change in some organizations. Not surprisingly, early adopters that have experienced the greatest transformations appear to be those companies that have developed collaborative tools initially for their own use—such as Google, Salesforce, and the like. These firms likely benefit most from the cloud both because their tech-savvy employees are at the natural leading edge of cloud adoption and because these firms lack the technical and

organizational legacies that limit other firms from achieving similar benefits. It is not clear, at this point, whether the cloud can *enable* changes in organizational structure (such as flattening) or, instead, if the firms that will benefit most from the cloud need to be flat before adoption.

In this section, we first provide a brief review of research that has studied how prior IT adoption has improved productivity, focusing on the organizational structures that maximize the returns to IT investment. We then describe an additional case study—of Salesforce—where the culture seems conducive to getting the most out of the cloud. Finally, we discuss the impediments that firms that are structured more traditionally may face in maximizing benefits from the cloud.

A. Lessons from the use of pre-cloud IT products

Cloud computing is not the first technology that has been predicted to enhance output and transform organizations. The adoption of mainframe computing in the 1970s and the subsequent widespread use of personal computers and the client-server model were expected to have a substantial impact on workplace outcomes. Academic research has demonstrated that adoption of this type of IT has increased productivity, at least in organizational environments that are conducive to exploiting IT's benefits. For example, studies using firm-level data have established that there exists a positive average relationship between IT use and productivity across firms; see, for example, Brynjolfsson and Hitt (1995). Dozens of other studies have confirmed this finding.[25]

A central finding of this literature, for our purposes, is that while there is a positive effect of IT on productivity *on average*, there exists substantial variation across firms in the degree of success with IT. This finding suggests that there are important firm-specific factors that affect the returns to IT investment. In this section, we briefly review the literature on *how* organizations have accomplished increases in productivity, focusing on the implementation of complementary organizational practices ("complementarities") that intensify the benefits realized from IT adoption.

The idea behind complementarities, the economics of which were first modeled in Milgrom and Roberts (1990), is that the marginal benefit of using IT increases with the adoption

[25] For reviews of this literature, see Brynjolfsson (1993), Brynjolfsson and Yang (1996), Brynjolfsson and Hitt (2000), Dehning and Richardson (2002), and Brynjolfsson and Saunders (2010).

of organizational practices that complement the IT investment. This set of organizational practices—characterized by greater degrees of individual decision authority for highly skilled workers, broader job assignments, increased training of workers, and incentives that encourage team performance—is designed to maximize the benefits of lower costs of communication and information-gathering and processing generated by IT.

While we do not undertake a comprehensive review of the literature on this topic here, it is useful to summarize some of the findings that relate to how particular organizational practices have amplified the benefits that firms have achieved through IT adoption. See Brynjolfsson and Saunders (2010, Chapter 4) and Brynjolfsson and Milgrom (2012) for detailed reviews.

Autor, Levy, and Murnane (2002) find that the impact of technological change on productivity and re-organization of work practices depends critically on non-IT factors, including workforce skills and managerial decisions. The authors studied the effects of check-imaging and optical-character-recognition technology in two departments of a large bank. They found that in the deposit-processing department, the technology substituted for less skilled workers and re-organization resulted in narrower jobs for the remaining employees. Meanwhile, in the exceptions-processing department, the technology was associated with broader jobs, more extensive training, and greater use of incentive pay.

Bresnahan, Brynjolfsson, and Hitt (2002) emphasize the key role of skilled labor and a "cluster of related innovations" in organizations as complements to IT adoption. In particular, they find that skilled labor is complementary to three changes at the firm-level: IT use, new organizational practices (including decentralization of decision-making authority and team-based work), and the development of new products. Their empirical work suggests that the implementation of this set of complementary organizational practices makes investment in IT more productive than in the absence of such complementarities.

Bartel, Ichniowski, and Shaw (2007) reach qualitatively similar conclusions using plant-level data from the valve manufacturing industry. They find that adoption of IT is associated with a set of complementary changes within firms in their sample, including changes in work organization and overall business strategy. Specifically, they find that IT adoption coincides with an increased demand for skilled workers (while substituting for routine machining skills), the use of new human resource management practices (including team-based work, shop-floor

meetings for information sharing, and training in technical skills), and production of more customized valves.

Several papers have focused specifically on the relationship between IT investment and decentralization of decision-making in organizations. Acemoglu et al. (2007) develop a model predicting that a firm's adoption of a new technology is associated with greater delegation of authority by the principal to the agent. Their empirical tests are consistent with this notion. Bloom, Garicano, Sadun, and Van Reenen (2011) observe that it is important to distinguish between IT's two main effects—reducing the cost of information acquisition and reducing the cost of communication—because they have different implications for the optimal organizational structure. In particular, enabling information acquisition pushes decisions *down* the organizational hierarchy as workers can more easily access information necessary to make decisions. Conversely, reducing communication costs pushes decisions *upward* as it becomes easier to communicate information to the top of the hierarchy. Finally, while not focused on IT adoption per se, Caroli and Van Reenen (2001) studied potential complementarities between organizational change—namely the decentralization of authority through flattening of the hierarchical structure—and skilled labor in a sample of British and French firms. Among their findings are that implementation of this type of organizational change in firms reduced demand for unskilled labor; shortages of skilled labor depressed the likelihood of organizational change; and organizational change was more effective at increasing productivity in firms with skilled workforces than in firms with relatively unskilled workforces. Caroli and Van Reenen's findings suggest the existence of "skill-biased organizational change" that may be accelerated by IT adoption.

Finally, a recent paper by Bloom, Sadun, and Van Reenen (2012) considers whether complementary practices can explain the divergence in productivity growth rates after 1995 between the U.S. (where the growth rate has accelerated) and Europe (where it has not). To address this question, they compare the performance of U.S. multinationals operating in Europe and the U.K. with non-U.S. multinationals operating in these same regions. They find that U.S. multinationals use IT more intensely than non-U.S. multinationals. They also find that U.S. multinationals have higher levels of "people management" practices that include greater managerial effort in hiring new employees and addressing underperformers, more aggressively promoting high-performing employees, and more intensive use of incentives for employees.

Moreover, they find that a complementarity exists between IT and people management practices, so joint adoption amplifies productivity improvements beyond those that would occur if the effects of IT and these organizational practices were only additive. The authors conclude that a deficiency in the joint adoption of IT and complementary practices by European firms has contributed to the lower productivity growth observed in Europe.

This literature collectively demonstrates that the degree of productivity enhancement achieved by a firm investing in IT depends crucially on the organizational structure that is already in place at the firm or is adopted in tandem with the new IT systems. In other words, to experience maximal productivity gains, firms need to have access to both IT and a set of complementary organizational practices. Firms that have the appropriate organizational structure (or "culture") that embodies characteristics such as employee empowerment, nurturing of collaboration, an emphasis on skilled workers, and recognition of high performers could realize substantially greater productivity improvements from IT adoption. Firms that overlay IT investments on organizational structures that are hierarchical and rigid, however, are unlikely to see improvements that are as meaningful.[26]

B. Adoption by firms with "Cloud Cultures"

Perhaps not surprisingly, the firms that have experienced some of the greatest gains in organizational outcomes from the cloud are the cloud providers themselves. This may be not only because the employees at these firms are skilled in using the technology and were the earliest adopters of cloud products, but also because these firms may have the cultures and complementary practices identified above that allow them to benefit from IT adoption. In particular, these firms often feature employee empowerment, decentralized decision-making, and self-managed teams. Here, we provide an overview of how one technology company, Salesforce.com, has used the cloud internally.

[26] This conclusion is also one of the lessons from the Business Process Reengineering (BPR) movement that emerged in the early 1990s (see Hammer (1990), Davenport and Short (1990), Hammer and Champy (1993), and Davenport (1993)). BPR proposed that companies that radically redesigned their business processes with the assistance of IT would achieve dramatic performance improvements. BPR was perceived by many to be a failure, in part because firms tried to "pave the cow paths" by automating existing practices without being mindful of the changes in culture and organizational structure that were also necessary. For assessments of BPR, see Champy (1995), Davenport (1995), and Hammer (2007).

Case Study #7 – Salesforce.com[27]

Salesforce.com is a company at the cutting edge of cloud technology and is potentially a good example of how some companies may use the cloud in the future. Salesforce first developed its flagship CRM product and has since expanded into a variety of other applications. Salesforce not only develops cloud-based products, but also uses them extensively within its own business and has even started a new consulting division—at the request of its customers—to assist outside companies in the implementation and effective uses of cloud products.

After its CRM product, one of Salesforce's most popular offerings is Chatter—an enterprise social network that allows employees to more easily identify colleagues with pertinent information, among other capabilities. Users of Chatter can explore colleagues' profiles and expertise, monitor real-time feeds on project status, form groups to collaborate on projects, and post messages and requests within their organization (and outside of the organization for relationships involving other firms). As such, Chatter reduces information-gathering costs by allowing users to identify colleagues with important local information and facilitates communication through the use of feeds and messaging services. Chatter is one of several cloud products that provides opportunities to use information residing in organization members' internal networks for such purposes as career development, team formation, and organization redesign (e.g., "expert finding" within organizations).

Salesforce has used tools like Chatter internally to improve productivity by amplifying the effect of its cultural norm of responsiveness to colleagues and speed in decision-making. According to Peter Schwartz, overt efforts to change company cultures almost always fail, but the use of new technology and innovation can assist in culture changes. The widespread use of cloud products at Salesforce—itself a flat organization—hints that cloud products are implemented more successfully in organizations with structures and cultures that complement cloud adoption.

C. Impediments to adopting the cloud

Transformation of traditional organizations alongside, or in response to, adoption of the cloud may happen more slowly. Independent of new IT, reorganization is often difficult, so one

[27] Information in this case study is based on an interview with Peter Schwartz, Senior Vice President for Global Government Relations and Strategic Planning at Salesforce.com, and the company's website (www.salesforce.com).

would not expect to observe such changes in firms at this early stage in the diffusion of cloud technology. Moreover, there are other impediments to universal use of the cloud that may either prevent certain organizations from adopting or limit the productivity enhancements associated with adoption. Here we touch briefly on both between-firm impediments (contracting problems in outsourcing IT to a cloud provider—i.e., transaction costs) and within-firm impediments (politics and other consequences of misaligned interest—i.e., organization costs).[28]

Some firms may be reluctant to move to the cloud because they are concerned about "hold-up" issues with cloud providers. For example, potential adopters may fear that technological lock-in with a particular cloud provider will lead to price increases and denigration of service in the future. Such "post-contractual opportunism" is of course both common in practice and widely discussed in the academic literature; see Klein, Crawford, and Alchian (1978) and the lengthy subsequent literature.

Interestingly, some cloud providers have developed business models based on open standards and portability of data and applications that limit such hold-up concerns. For example, Google's Data Liberation Front assists users in moving data out of Google products using Google Takeout.[29] Google also uses short-term contracts (about one year) and its App Engine supports commonly used programming languages such as Java and Python. In a similar spirit, a group of cloud developers participates in a consortium called OpenStack (founded by cloud service provider RackSpace) that has created an open-source cloud platform for application development that encourages interoperability across providers.[30] Such endeavors can be seen as attempts by providers to make it impossible (or at least much less likely) that a user will be locked into a single provider's technology.

Adoption of the cloud may also be impeded by issues *within* firms, such as those stemming from misaligned interests and internal politics. For example, in our interviews we heard about "blockers" to adoption, such as CIOs who resist moving to a service model that they are unfamiliar with and unprepared to manage. The cloud can fundamentally change the CIO's job from one that is technical in nature to one that requires enabling change and innovation

[28] There are other impediments to cloud adoption that are beyond the scope of this paper, including regulatory and privacy laws in certain locales that make adoption difficult, and certain technical limitations, such as incompatibility of the cloud with an organization's existing IT investments.

[29] See http://www.dataliberation.org.

[30] See http://www.openstack.org.

within the organization. As a result, successful adoption of the cloud may require support at the CEO level. Alternatively, we heard other examples where the IT departments were the strongest advocates and most intensive users of cloud services.

Other within-firm impediments to cloud adoption or performance could occur when a "command and control" structure is necessary for an organization to produce its output: in such a setting, the returns to allowing local actors to adapt to increased local information could be greatly reduced or even negative. More generally, the host of complementary organizational practices discussed in Section IV.A may indeed amplify the potential returns to adopting IT (including the cloud), but each of these organizational practices could raise internal political and cultural issues. For example, greater degrees of individual decision authority for highly skilled workers may threaten the managers of these workers, even outside a setting where command and control is necessary for successful production. Likewise, broader job assignments and incentives that encourage team performance often require managers to operate more by discretion than by rule, creating the possibilities of misunderstandings of how this discretion is supposed to be used or misuses in how it is in fact used; see Gibbons and Henderson (2012) for more.

These between- and within-firm impediments to adopting cloud technology relate to our main focus in this essay: how can outsourcing IT to the cloud improve productivity inside organizations. But there is another potential application of cloud technology, and with it comes another potential impediment to cloud adoption. This further application of cloud technology involves collaboration *between* organizations, such as in various business-to-business (B2B) contexts—a hand-in-glove supply relationship, a joint venture, or a consortium of firms, and so on. In B2B settings, the productivity improvement arises not from the adopter's internal activities but instead from improvements in how the adopter works with its external partners.

But this B2B application of cloud technology comes with its own impediment: some interviewees stated that concerns about control of information and security have made them reluctant at this point to use the cloud to interact with external partners. At Ocado, for example, despite successful use of Google Apps for real-time collaboration within the firm, they have concerns about external sharing due to difficulty in controlling proprietary information and tracking which information can be or has been shared when and with whom. For this reason, Ocado does not currently use Google Apps to collaborate with outside parties, even though some of its product and equipment suppliers have approached it about collaborating through the cloud.

Nor is this concern strictly technological: improvements in security might help increase the adoption of the cloud for interactions with external partners, but the potential for misaligned interests that can surface even within a firm may be even greater between firms, thus creating a second potential reason for slow adoption in B2B settings.

V. Conclusion: Why Might the Cloud Do (Even) Better Than Prior IT-Based Efforts to Improve Productivity?

The cloud is still a relatively unexploited product in the grand scheme of organizations' adoption of IT services. Despite this fact, we have heard from adopters that they are already observing tangible improvements to productivity within their organizations. In assessing the longer-term effects of the cloud on organizations, one might wonder how the cloud and the current enterprise computing environment are different from the past. In particular, how can the cloud (1) facilitate the types of productivity improvements that were envisioned but often not realized by firms implementing past computing models, and (2) allow for further productivity improvements in firms that have benefited from previous technologies?

There are several characteristics that may distinguish the cloud from past IT use and make it likely to further enhance productivity in organizations.

1. *The organizational practices that complement IT may be better understood.* Since the time that modern computing was first adopted by organizations, economists and business strategists have comprehensively studied the optimal manner in which technology should be implemented in order to improve performance. As we discussed above, the importance of complementary organizational changes has been recognized and demonstrated in numerous studies. Consequently, we expect that managers are less likely now to merely pave the cow paths—i.e., use cloud products merely to reproduce existing organizational practices (albeit at lower cost, greater speed, or higher accuracy)—than they might have been in the past. We conjecture that this understanding of the importance of complementary actions may result in organizational changes that attempt to optimize the information-gathering and communication benefits of the cloud.
2. *The cloud requires only web access.* The cloud greatly simplifies the logistics associated with adoption of this technology. In the past, adoption required purchasing

and maintaining hardware and software by an internal IT department; in contrast, using the cloud can be as simple as creating an account with a provider and accessing cloud services through a web browser. These lower start-up costs allow adoption by organizations that in the past may not have had sufficient capital. For example, micro-multinationals—small firms that operate globally—have taken advantage of low-cost cloud services to provide their communications and information-processing infrastructures.[31]

3. *Devices are better suited to location-independent use of IT.* Recent hardware inventions, such as smart phones and tablet computers, are well suited to exploit the cloud's ability to allow access to information from any location. We expect that this aspect of the cloud will result in faster communication by allowing employees to review files, check project-status updates, and send messages remotely, for example. Moreover, there may exist a *direct* productivity improvement associated with allowing employees to work outside of the office. A recent paper by Bloom, Liang, Roberts, and Ying (2012) found that call-center employees at a large Chinese company experienced a 13% increase in productivity when working from home compared to working in the office. If this result generalizes, it suggests that the cloud's ability to facilitate remote work may yield productivity improvements beyond those related to the information-gathering and communication benefits that we discuss in this paper.
4. *Employees are more adept at using technology.* Employees today are much more savvy about using technology than they were in the past, in part because many use technology in their personal lives. In fact, a common reason that organizations give for adopting Google Apps is that their workforces have experience using these tools outside of the office, particularly Gmail and Google Chat. Moreover, employees in some firms have been quicker to embrace the cloud than their managers, migrating data and applications to the cloud without going through official organizational channels. Such "rogue" use of the cloud reveals that employees perceive there to be computing needs that are served by the cloud but not by their in-house IT services.[32]

[31] See Varian (2011).

[32] See Linthicum (2011).

One interviewee related a story about a manager who wondered "How could we be buying so many books from Amazon?" based on his review of employees' expense reports. It turned out that his employees were not buying books from Amazon, but rather were using Amazon's cloud products.

5. *Employee use does not depend on IT control.* Past use of IT in organizations relied on IT departments to configure hardware and software and distribute applications to employees. The cloud removes the IT department as the sole provider of technology. As a simple example, employees can develop Google Sites to manage projects, whereas in the past such a request may have required IT staff to centrally manage the site on a corporate intranet.

Whether the cloud turns out to be a revolutionary computing invention remains to be seen. We anticipate that the initial progress reported in this paper is only the beginning of how the cloud will ultimately enhance productivity in organizations.

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Appendix

Overview of Cloud-Computing Products

Google Apps – A suite of applications powered by Google, but administered by an individual company or organization. Google Apps consists of a core suite of applications, including Gmail, Chat, Calendar, Drive, Docs, and Sites, as well as several additional applications and features.[33]

Google Docs (includes **Google Spreadsheets**) – Google's application that allows users to upload, create, and download spreadsheet, presentation, and word-processing documents. Users can view, share, and edit the documents online. Users can collaborate on the same document through direct editing and social commenting.[34]

Google Drive – Google's file-saving and file-sharing system that allows users to upload and download files, as well as organize and share files – individually or within folders – with other users. Google Drive, which supports over 30 different file types including images, videos, and PDFs, is where Google Docs are stored.[35]

Gmail – Google's email application. Gmail is included in Google Apps for Business, which comes with 25GB of email storage per user. Companies can select an email address to match the company name (i.e., @businessname.com instead of @gmail.com).[36]

Google+ – Google's social networking application that allows users to locate other users, share information publically or within groups, and host online video meetings.[37]

Google Chat – Google's instant messaging feature that allows users to chat from within the Gmail or Google Docs interface. Add-ons to the chat feature allow users to engage in voice or video chats, or chat in Google Chrome outside of the Gmail or Google Docs window.[38] Distinct from Google Chat, Google Talk is a downloadable chat application that allows users to send text, voice or video chats.[39]

Google Sites – Google's application that allows users to build project sites, either from scratch or from pre-designed templates.[40] Sites can serve as an internal platform for users within an organization to collaborate on documents or as a public-facing site.[41]

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[33] http://www.google.com/enterprise/apps/business/products.html and http://support.google.com/accounts/bin/answer.py?hl=en&answer=72709

[34] http://www.google.com/enterprise/apps/business/products.html#docs

[35] http://www.google.com/enterprise/apps/business/products.html#drive

[36] http://www.google.com/enterprise/apps/business/products.html#gmail

[37] http://www.google.com/enterprise/apps/business/landing/plus/index.html

[38] http://learn.googleapps.com/chat

[39] http://www.google.com/talk/about.html

[40] http://www.google.com/enterprise/apps/business/products.html#sites

[41] http://learn.googleapps.com/sites

Google Apps Script – A cloud scripting language based on Javascript that allows for the automation of tasks across Google products and third-party services.[42]

Google Forms – Google's application that allows users to create and administer a survey and see responses automatically populated in a Google Spreadsheet.[43]

Google Groups – A feature within Google Apps that allows users to self-organize into groups. Once a group is created, members have access to a group email address and can receive group-wide access to different files, sites, or calendars. Members that are added to the group automatically receive the same level of access as the group, while members that leave the group lose access. Groups can be designed to have restricted membership – where new members must be approved by IT or the group creator – or open membership – where non-members can self-select into the group.[44]

Google Takeout – Google's "Data Liberation" platform that allows organizations to exit their data from multiple Google products at once. Users can choose the format to which they want to export each of their files.[45]

Google App Engine – Google's Platform-as-a-Service (Paas) product that allows users to build, maintain, and scale their own custom applications without the need to maintain servers. Applications can be written in different programming languages and can run in one of three runtime environments: Java, Python, or Go.[46]

Salesforce Chatter – Salesforce's social and collaboration platform that allows users to locate information about colleagues, groups, files, or reports. Users can opt to "follow" these selections to see real-time updates and take part in conversations through forum pages or the chat feature.[47]

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[42] https://developers.google.com/apps-script

[43] http://www.google.com/google-d-s/forms

[44] http://www.youtube.com/watch?v=29n6xm1dLiI

[45] http://www.dataliberation.org/takeout-products

[46] https://developers.google.com/appengine/docs/whatisgoogleappengine

[47] http://www.salesforce.com/chatter/overview