



Policemen, managers, lawyers: New results on complementarities between organization and information and communication technology

Luis Garicano ^{a,b,c}

^a LSE, United Kingdom

^b CEP, United Kingdom

^c CEPR, United Kingdom

ARTICLE INFO

Available online 1 April 2010

Keywords:

ICT
Firm organization
Wage inequality

ABSTRACT

Recent empirical work sheds some light on the importance, form and consequences of complementarities between information and communication technology (ICT) and organizational design. We conclude from this research that (1) complementarities between organization and ICT may be so strong that absent organizational changes, ICT may have a negligible effect on productivity; (2) different types of ICT require different changes in organizational design; (3) the evidence also suggests that changes in organization enhance the impact of ICT on wage inequality.

© 2010 Published by Elsevier B.V.

1. Introduction

In an influential analysis of the organization of modern manufacturing, [Milgrom and Roberts \(1990\)](#) have argued that, given the existence of complementarities among organizational practices, a range of organizational choices may have to be altered together for a particular technological advance to improve efficiency. In this view, in the presence of complementarities success is not “a matter of small adjustments, made independently at each of several margins, but rather involve[s] substantial and closely coordinated changes in a whole range of the firm’s activities.” Thus understanding the presence, importance and consequences of these complementarities is important both from a positive perspective (it is critical to understanding the sources of productivity growth) and a normative one (this is crucial information for managers trying to determine what organizational and technological changes to undertake).

The issue is of particular interest when the technological change concerned is information and communication technology. Organizations are designed to process and aggregate information, as [Arrow \(1974\)](#) first noted. Individuals are boundedly rational, and, by joining in organizations, they can collect together more information than each individual could collect on his own. If organizations are all about information processing, then we expect that exogenous changes in the cost of acquiring and communicating information must affect organizational design.

To illuminate these issues we review a recent set of empirical papers that are concerned respectively with the presence ([Garicano and](#)

[Heaton, 2010](#)), the importance ([Bloom et al., 2009](#)) and consequences ([Garicano and Hubbard, 2009](#)) of these complementarities.

2. Do complementarities matter? Police, organization and technology

A first important question then is to what extent is the ICT effect on productivity simply a direct effect of better technology and to what extent such effects must be mediated by organizational changes. In work with Paul Heaton ([Garicano and Heaton, 2010](#)), we answer this question in the context of the introduction of ICT in the US police departments. Productivity is measured by the efficiency of the police in deterring and solving crimes.

We use two data sources. First, the Law Enforcement Management and Administrative Statistics (LEMAS) series, a triennial survey of law enforcement agencies in the United States covering the years 1987–2003. Although not specifically designed as a longitudinal survey, the broad coverage of the survey makes it possible to identify numerous agencies at multiple points of time. The surveys provide rich data on a wide variety of police operations, including shift scheduling, equipment usage, agency structure and functions, officer compensation, and administrative policies. To supplement the LEMAS data, we have matched the surveyed agencies with annual arrest and offense data from the FBI’s Uniform Crime Reports (UCR) and place-level demographic data from the Census where possible. One of the strengths of this data set is that it contains questions on a variety of different types of IT use and covers a period of enormous IT expansion. Our basic empirical strategy compares productivity or organizational practices across departments that adopted differing levels of

E-mail address: luis.garicano@gmail.com.

computing technology controlling for city size and other characteristics, including unobserved agency effects.

We start by analyzing the relationship between computerization and productivity. We first uncover a striking puzzle: general IT adoption alone is not associated with improvement in the productivity of police work as measured by crime clearance (i.e. solving the crime) rates, and is actually associated with increases in crime rates. We carefully analyze the generality of these results, and find them robust to alternative samples (by period, early adopters, growing versus non-growing cities, etc.) and specifications of the IT measure. An immediate question follows: could this be, in part, the result of complementarities?

We uncover several pieces of evidence consistent with the complementarities hypothesis. We first demonstrate that IT adoption is associated with a variety of organizational changes within a department, including an expansion of personnel (primarily in technical support roles as opposed to field operations), increased use of special units, and enhanced training and educational requirements. Thus, departments that expanded IT use also modernized in other important ways. We next identify agencies that simultaneously implemented high levels of IT, specialization, and education, which we term “modern” agencies. In panel regressions that control for our underlying organizational and IT measures, we demonstrate that agencies implementing this combined set of practices experienced statistically significant drops in crime rates.

In the specific context of police work, the complementarity hypothesis takes one very salient form: Compstat. The bundle of practices summarized by this name was initially introduced in the New York Police Department by Police Commissioner William Bratton under Mayor Rudolph Giuliani’s leadership and then spread throughout the country. The program aimed to combine real-time geographic information on crime with strong accountability by middle managers in the form of daily group meetings, geographic resource allocation, and data-intensive police techniques. The program was widely credited in the press and by policymakers with playing a substantial role in the recent precipitous drop in crime experienced by some cities. Thus to further test the complementarities hypothesis, we study the impact of information technology when it is adopted together with management techniques characteristic of Compstat, including skilled officers, new problem-solving techniques, extensive use of ‘output’ information in evaluation and deployment of officers, and a geographic-based structure. Although the data available for testing this hypothesis are much shorter and more limited (questions on these types of practices were only introduced in the survey in 1997), they clearly endorse this hypothesis. We find crime clearance rates were an average of 2.2 percentage points higher in agencies implementing this integrated set of practices. Similarly, crime rates are negatively associated with Compstat use. Moreover, the individual practices composing Compstat have no independent ameliorative impact on crime levels or clearance rates.

The conclusion from this study is clear. Complementarities between ICT and organizational practices may be strong enough that the absence of complementary organizational changes may completely negate the effect of the technological improvement on productivity.

3. Does ICT always entail the same organizational changes? Managers

The changes in the organization of policing studied above have one limitation—the ICT used is very special, and so are the complementary organizational practices used. What are the general patterns of change across technologies? Is there anything we can say about these changes that is robust across types of functions and industries?

Some guidance on this question is provided by the literature. Garicano (2000) and Garicano and Rossi-Hansberg (2006) have

argued that a key distinction on theoretical grounds is between information and communication technology. The argument is as follows.

Decisions involve solving problems and thus acquiring the relevant knowledge for the decision. In determining at what hierarchical level decisions should be made, firms face a trade-off between *information acquisition costs* and *communication costs*. Making decisions at lower levels implies increasing the cognitive burden of agents at those levels. For example, decentralizing from the corporate head quarters (CHQ) to plant managers over the decision whether to invest in new equipment requires training the plant managers to better understand financial decision making, cash flows, etc. To the extent that acquiring this knowledge is expensive, the knowledge of the plant manager can be substituted for by the knowledge of those at corporate head quarters. Relying more on the direction of corporate head quarters reduces the cognitive burden on the manager and so lowers the total information acquisition costs. But this comes at the price of increasing communication between levels in the hierarchy, increasing total communication costs. From a cognitive perspective, decentralized decision making thus implies an increase in the cost of information acquisition to economize on communication costs: trading-off knowing versus asking for directions.

The level at which decisions are taken thus responds to the cost of acquiring and communicating. Reductions in the cost of communication allow for a reduction in knowledge acquisition costs through the increasing use of ‘management by exception’, e.g. local managers rely more on corporate managers for decision making. Reductions in the cost of information access, on the other hand, reduce the cognitive burden imposed by decentralized decision making and thus make more decentralization efficient. Consequently, information and communication technologies affect differently the hierarchical level at which different decisions are taken. Improvements in information technology should push decisions ‘down’ leading to decentralization while improvements in communication technology should push decisions ‘up’ leading to centralization.

In Bloom et al. (2009), we study whether this distinction holds in the data. We first start by studying manager’s non-production decisions—capital investment, hiring new employees, new product introductions and sales and marketing decisions. We argue that the key piece of information technology that has recently affected information access by these managers is Enterprise Resource Planning (ERP). These ERP systems increase dramatically the availability of information to decision makers in the company, that is they reduce the cost of acquiring information to solve a problem. It follows that they should increase the autonomy of the plant manager with respect to headquarters. We then consider factory floor *production decisions*. These are decisions on the production process that can either be taken by factory floor employees or by those in the plant hierarchy, such as which tasks to undertake and how to pace them. Here, a key technological change in the manufacturing sectors we focus on has taken place reducing the cost for workers of being informed: Computer Assisted Design/Computer Assisted Manufacturing (CAD/CAM). A worker with access to those machines can solve problems better, and thus needs less access to his superiors in making decisions. This technology should increase their autonomy and, by reducing the amount of help they need from plant managers, increase the span of control of plant managers.

On the other hand, as we argued above, we expect communication technologies to centralize decision making. This will be true both for production workers (so that plant managers will take more of their decisions), and also for plant managers (so that the central head quarters will take more of their decisions). A key technological innovation affecting communication is the growth of networks and connectedness. We thus also test whether the availability of networks reduced the decision making autonomy in production decisions of workers, and in non-production decisions of managers.

Download English Version:

<https://daneshyari.com/en/article/5078283>

Download Persian Version:

<https://daneshyari.com/article/5078283>

[Daneshyari.com](https://daneshyari.com)