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Office productivity

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The results of a literature study on white collar / office productivity are presented. Traditional methods regarding the measurement of productivity in an office environment have focused on the efficiency rather than the effectiveness (quality, timeliness) aspects of the office. McDonald & Conrath's concept of total office productivity includes both aspects. Although this method can be considered as the first real attempt to measure office productivity in a comprehensive way, much work must be done to operationalize the given methodology.

1. In search of a definition for productivity

A classical (and intuitively satisfying) general definition of productivity is the ratio of a given amount of desired output for a given unit of related input. Since the beginning of recorded history people have been trying to improve productivity. Attempts to accomplish this have been focused on controlling the balance between effort expended and output attained. The following paragraph depicts the changes in this balance during the pre-industrial, the industrial, and the so-called information age.

1.1. Worker productivity: An historical rebalancing of effort and output

Prior to the arrival of the industrial revolution, society was primarily agrarian. Guilds of tradesmen and craftsmen provided a small market for the surplus goods beyond those needed by the individual farming unit. Thus, the individual farming unit experienced little motivation to produce more than it itself needed. It is therefore safe to assume that the bulk of activity directed toward increasing productivity dealt with making a given unit of goods more easily. Finding ways to work less hard, rather than producing in great quantities, was the goal of the individual worker.

With the onset of industrialization, there arose a widespread money-based economy. Increasing the output of goods became more important than decreasing the input of labor, especially in the eyes of the ruling class [Macarov, 1982].

In the so-called 'information age' (of tomorrow) there will be yet another balance struck between effort and output. This emerging period will be char-

acterized by information content and brain intensiveness. Industries will be populated by a new force of knowledge workers and a new productivity ingredient will be relevant: augmentation. Augmentation occurs when technology is used to provide entirely new ways of accomplishing tasks and objectives: technology augments the capabilities of individuals and groups [Panko, 1981; Smith, J., 1984].

In America, the notion of augmenting human labor has been translated in the slogan "Working smarter, not harder". This attitude is typified by a spokesman for Intel's productivity program: "The key to making a productivity program successful is to make it measurable, to determine how effectively our work is performed. Are we working smarter or just harder? Have we found easier ways to get the job done?" [Intel, 1984]. J. Kendrick, a leading expert on productivity, agrees. In a recent interview he stated, "... it is not how hard people work, it is 'working smarter' that increases productivity" [Economic impact, 1984].

1.2. Worker productivity: attempts at quantification

A careful reader may have noticed that so far only a very general definition has been given of productivity, i.e.: a given unit of desired output for a given unit of related input.

$$P = \frac{DESIRED\ OUTPUT}{RELATED\ INPUT}$$

A more tangible definition of productivity would have to include any one of a number of possible measures whereby a certain input is used to create a certain output. If this input level is decreased so that less is required to maintain a given level of output, then one can conclude that productivity is improved. Conversely, if a fixed level of input is used and a higher level of output is achieved, one can again conclude that productivity is improved. The real problem is the choice of the parameters to be used to determine the proper input and output measures in a given situation [Saunders, 1982]. As it turns out it is a remarkably complex task to define the specific determinants that measure worker productivity. A method to measure worker productivity does not measure simply the output of the worker, but a whole "invisible system" of factors that influence worker productivity. To be precise, invisible factors must become not only visible but properly accounted for. Figure 1 lists more than thirty candidates, yet there is no underlying confidence that this list is complete.

As a result, researchers and managers tend to concentrate on single variables (e.g. labor productivity) or small clusters of vaguely defined variables (e.g. quality of work life), dispensing with further concerns over completeness.

Recent quotations from recognized productivity 'experts' add much validity to the notion that productivity is an ill-defined concept:

- Packer [1981]: "Attempts to define and measure productivity have kept scores of consulting firms, academics and managers gainfully employed for decades. Their efforts have resulted in a plethora of definitions which easily confuses many analysts and users of productivity information."

PRIMARY FACTORS	
Task capacity (potential performance)	
Individual effort	
SECONDARY FACTORS	
Raw materials	Capital investment
Task design	Individual capacity
INDIVIDUAL FACTORS	
Knowledge Skills	Attitudes
ORGANIZATIONAL CONTROLLABLES	
Product and process design	Communications
Selection	Peer relationships
Training	Qualitative rewards
Supervision	Monetary rewards
DEMOGRAPHICS OF THE ORGANIZATION AND ITS INDIVIDUAL MEMBERS	
Volume	Informal organization
Labor market	Individual preconceived attitudes
Labor union	Organizational climate
Individual health	
FILES OF INFORMATION	
Industrial engineering	Personnel knowledge
Money market	Technology
Human relations	Comparison of pay scales

Source: Adapted from Ruch and Hershauer, *Factors Affecting Worker Productivity*. Tempe: Arizona State University, 1974.

Fig. 1. Factors that affect productivity.

Source: Alexander Hamilton Institute [1977], p. 3.

- Byars [1981]: "Everyone seems to have a definition of the word productivity. Unfortunately, most of the definitions are general in nature and rarely agree."
- Gale [1981]: "Measuring productivity is not easy."
- Sink [1983]: "Productivity is an extremely abused and misused term. This is because there has been no disciplined attempt to stand up and say 'That is what it is and that's all it is.' The half truth rhetoric floating around about productivity is absolutely amazing. It has become a buzz-word that almost every discipline and profession imaginable has grabbed onto it and began to use it in an attempt to further market and promote its own often myopic 'solutions'. The need for synthesis, clarification, disciplined definitions and a generic framework is quite evident."

Thus there seems to be a sort of "productivity measurement crisis".

It has also been observed that the meaning of the word productivity depends on one's point of view. Judson, for example, distinguishes among technical, economic, and social productivity [Muckler, 1982]:

- *Technical productivity* is associated with the workplace and concerns the direct goods or services produced by individuals or work groups coupled with the tools of the workplace. Most discussions are concerned with this type of productivity and, of course, enhancing it.

- *Economic productivity* will not automatically result from increased technical productivity, as is commonly assumed. Greater investment in the workplace to increase technical productivity may result in increased operating expenses and hence non-competitiveness for the products or services.
- *Social productivity* refers to the desirability and/or usefulness of the products or services produced.

Perhaps other schemes are possible (?).

The above was concerned with types of productivity. One could also think in terms of the socio-economic levels of productivity that are present in day-to-day life: the national, regional, organizational and individual levels. Because of the considerable interest in productivity issues as concerns both management and government, it is appropriate to consider, in depth, productivity measurement at the national and organizational levels.

1.3. Typical measures of productivity at the national level

The most common measures of productivity at the national level are usually published by the governments of various countries (e.g. USA: the National Bureau of Labor Statistics; The Netherlands: Centraal Bureau voor de Statistiek). For its purposes the US Bureau of Labor Statistics defines productivity as follows: Productivity is the ratio between the production of a given commodity measured by volume, and one or more of the corresponding input factors, also measured by volume.

The specific measure of productivity that is frequently reported by this agency is labor productivity, which is defined as the ratio between the total value of goods and services produced divided by the total number of hours of paid work. Labor productivity, however, is too narrow a concept to be considered an adequate measure or definition of the term 'productivity'. Labor productivity overlooks that it takes more than labor to produce goods. Consideration must also be given to the level of capital investment and all other costs of doing business.

In conclusion, the main problem is that nobody really knows what better definition or measures should be substituted for the concept of labor productivity [Alluisi & Meigs, 1983].

1.4. The measurement of productivity at the organizational level

By productivity at the organizational level is meant a measure or index of the overall performance of an organization. It is essentially the aggregate of the results accomplished by individuals, departments, and business units within an organization. Productivity at the organizational level has always been a management concern. In his article "The awkward truth about productivity", Judson [1982] presents an overview of the important factors relative to productivity in 195 US industrial companies:

- Management ineffectiveness is by far the single greatest cause of declining productivity in the United States.

- Most companies' efforts to improve productivity are misdirected and uncoordinated.
- Tax disincentives, the decline of the work ethic, problems with government regulation, obsolete plant and equipment, insufficient R&D, and poor labor relations all have little to do with industry's faltering productivity.

These remarkable results suggest that improving productivity should be one of the major management goals of the 80s. There is however an important management law which states that "Productivity must be measured if it is to be improved." As we have seen, measuring productivity at the organizational level is a complex matter.

In "Productivity analysis in public and private sector organizations: an integrated approach to analysis and interpretation of productivity data", Packer [1981] presents an integrated approach to the analysis of productivity at the organizational level. A few examples taken from this work will illustrate the complexities with which we are faced.

Example I: Issues and problems in the definition of input and output

First of all, there is the problem of identifying on a practical level the inputs and outputs of an organization (for example: What is the output of a laboratory – innovative ideas or new materials? What is the input – ideas or apparatus? How do they relate?). Secondly, there is the difficulty in the definition of inputs of the organization (e.g. how do intangible factors as worker motivation, management skill, and social and cultural climate contribute to the generated input of an organization?). Even the terminology is confused.

Output vs *outcomes*. Output = immediate results of an organizational activity. Outcomes = ultimate effects of the organization upon the outside world (wanted and unwanted).

Efficiency vs *effectiveness*. The distinction 'output/outcomes' is mirrored in the twin concept of efficiency and effectiveness. Efficiency = how well the organization does in converting the input resources into immediate outputs: how 'productive' the organization is doing what it should be doing. Effectiveness = how well the organization is using the input resources to meet its ultimate goals: how 'productive' the organization is in accomplishing what it should be doing.

Example II: Issues and problems with the relation between inputs and outputs

Even if we were able precisely to define input and output, we should still be faced with the problem of how appropriately to relate the two. In any organization there are normally a variety of inputs and a variety of outputs. All possible interrelationships must be accounted for. The more variables are included the more intractable the situation becomes. As the comprehensiveness of the productivity calculation increases, so (unfortunately) does the cost of the analysis.

Example III: Issues and problems in the meaning of productivity fluctuations

Increased organizational productivity does not necessarily mean that the organization is better off in terms of profitability, competitiveness, or any other

measure of organizational health. *Numbers speak for themselves, but they usually speak obscurely when they are economic aggregates*. As Herbert Stein has stated, it is obvious that productivity statistics do not measure justice, security, happiness, beauty, or the lack of them, and we cannot be sure in what direction our available measurements may be biased.

From the above we can arrive at the following conclusions:

1) The concept of productivity is both subjective and complex. The more aspects or dimensions we consider, the closer we come to the proper definition/scope of the concept. Unfortunately, as the definition broadens, the implementation cost of the productivity analysis can quickly pass the point of diminishing returns.
2) No generally applicable operational definition of productivity is possible. The definition varies with the nature of the operation and the point of view of the observer.
3) Elegance of method will not prove useful.
4) Productivity measurement must be judged as an art in evolution and an area of unfinished business. The following list of articles and books sums up the recent attempts to overcome this rather unpleasant situation:
   - Packer, 1981 and 1985
   - Sink, 1983 and 1985
   - Harl & Bresser, 1984
   - Kendrick, 1984
   - Bitran & Chang, 1984

2. Productivity in relation to industrial and organizational psychology

Productivity means different things to different people. To workers productivity means a speed-up in their work patterns or attempts to 'work smarter, not harder'. To union leaders it means the opportunity to negotiate for higher wages or a decrease in working hours per week. To management it means increased profitability. To consumers it means (better) goods at lower cost or (better) quality service. To marketing directors productivity improvement means increases in the firm's competitiveness. To economists increases in output per man hour mean an increase in a country's standard of living. Having different points of view seems to be inherent to the concept 'productivity'.

In his article "Organizational productivity: a challenge for psychologists", Tuttle [1983] discusses how productivity might be considered from the viewpoints of economics, engineering, accounting, management, and industrial and organizational psychology. He notes that some disciplines have developed narrow productivity measures (ratio's and indices, e.g. economics, engineering and accounting) while others have adopted more encompassing indices regarding productivity.

For our purposes it is instructive to look closely at the industrial and organizational psychologists' view of productivity. According to Tuttle [1983], industrial

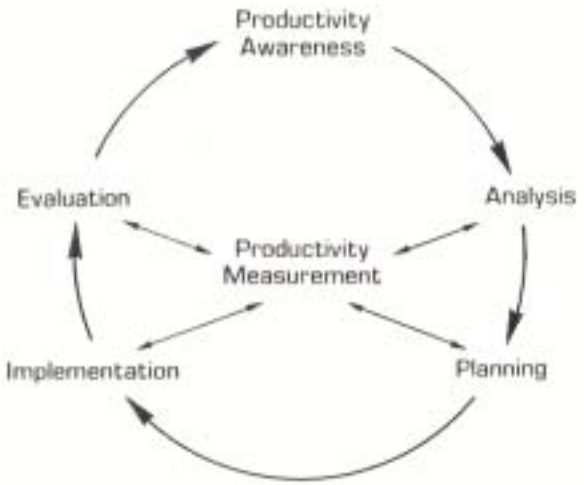

Fig. 2. Productivity management process.

Source: Tuttle [1983], p. 483.

and organizational psychologists are primarily concerned with explaining human behavior in organizations. Productivity, defined as output/input, is a "results"-oriented variable. It is partially a function of behavior but is also affected by other extraneous (to the psychologist) aspects of the work environment. Thus, productivity has not proven itself as a tool or measure by which to define or explain worker behavior.

While the term 'productivity' frequently appears in the literature of industrial and organizational psychology, its meaning is usually vague. Often it is erroneously equated with production or performance * [Tuttle, 1983].

An illustration of this vagueness can be found in the very same issue of *American Psychologist*. In an article entitled "Psychological approaches to productivity improvement", Katzell & Guzzo [1983] state: "We are flexible in defining productivity to include output, quality, costs, turnover, absenteeism and disruptions such as accidents, in keeping up with the popular conception of the term". Here "flexible" can be equated to vague. From the point of view of productivity improvement in organizations, a definition of productivity as efficiency and effectiveness might prove more useful.

The question arises at to what opportunities are available to psychologists to contribute to organizational productivity improvement programs. According to Tuttle, the productivity management process in an organization can be viewed as shown in figure 2. The process has five mutually dependent aspects. For each aspect psychologists have unique methods and expertise to contribute [see Tuttle, 1983, p. 484–485!]. As figure 2 illustrates, measurement plays a central role in *all*

* Even this is too narrow a conceptualization. According to Sink [1983], performance is a broad concept comprised of at least seven criteria: effectiveness, efficiency, quality, productivity, quality of the worklife, innovation and profitability!

phases of the productivity improvement process. It provides an objective basis for productivity *awareness* evaluation. Measurement of past performance helps in the *planning* stage to predict future performance and guides planners in setting meaningful and realistic targets. In the *analysis* stage, measurement of productivity may have diagnostic value. Measurement data are essential to enable analysts accurately to distinguish high-productivity from low-productivity groups. With respect to *implementation*, measurement may help a manager determine when and where changes should be introduced. Measurement is critical in the *evaluation* phase in order to assess productivity changes resulting from organizational change.

Measurement, however, is not an end in itself. Organizations measure productivity to stimulate improvement. The most sophisticated measurement system is useless if the members of the organization do not accept and use it [Tuttle, 1983]. In this context, Packer [1981] takes note of the following situation: "Like all

A. Basic Objectives:	– What exactly are you trying to get done? (not what does the system look like?) – What resources are needed? – Who controls them, directly or indirectly? – How can you minimize the effects of social inertia?
B. Dilemmas of Administration:	– What elements are critical? – Are any of them subject to monopoly interests? – Will their owners be incooperative? – Can you work around them or buy them off? – Will they respond with delays or tokenism? – How will you deal with massive resistance?
C. Games:	– What games are likely to (a) divert resources? (b) deflect goals? (c) dissipate energies? – How can you counteract or prevent them, if necessary by redesigning the project?
D. Delay:	– How much delay should you expect? – What negotiations are needed? – What resources do you have for negotiations and/or control? – Would it help to use project management, work around possible obstacles and delay or enlist intermediaries?
E. Fixing the Game:	– What senior management and staff aid do you need? – What resources do they have? – What incentives are there for them to play the fixer role? – Can you build a coalition to fix the game?

Fig. 3. Scenario-writing.

Source: Keen [1981], p. 30.

organizational changes, a productivity analysis system will be resisted. Peter G.W. Keen gives a colourful and highly instructive review of the myriad counter-implementation games and strategies which are used to block productivity improvement efforts; games which depend upon social inertia, on keeping the project complex or vaguely defined, on withholding crucial information, and on dissipating the energy of project advocates. Thereafter he presents a series of questions [see fig. 3] that analysts should carefully examine before attempting to implement change in an organization. These deal with the politics of implementation and resistance. While distasteful, it is nonetheless an integral part of the analyst's job."

In order to solve problems associated with the politics of implementation and resistance, a multi-disciplined approach is required. Psychology must be integrated with engineering, accounting, and economics if one wants to improve productivity in an organization. According to Tuttle [1983], this will require psychologists who are willing to tackle "messy" problems, learn new vocabularies, and work with individuals who must be "sold" on the value of psychological insights. Tuttle [1983] concludes: "*Developing such people is the productivity challenge for our profession in the decade ahead.*"

3. In search for meaningful definitions of non-factory work

Most commonly, productivity programs are aimed at the blue-collar workforce in factories. This trend is changing. Blue-collar workers now make up but a minor portion (16 to 17 percent) of the US workforce, as opposed to 65 percent as recently as the 1950s. By the end of this decade, the blue-collar workforce is expected to be about 10 percent of the workforce [Naisbitt, 1984]. Today, half of all American workers are white-collar workers. These trends are reported for America in the data of table 1 and for other industrial nations in figure 4.

Table 1
The white-collar explosion

Category	Percent of workforce			
	1900	1940	1980	1990 *
White-collar total	17.6	31.1	51.2	51.2
Managers	(5.8)	(7.2)	(10.9)	(10.7)
Professional/technical	(4.3)	(7.4)	(15.8)	(14.8)
Clerical	(3.0)	(9.6)	(18.3)	(19.0)
Sales	(4.5)	(6.7)	(6.2)	(6.7)
Other	82.4	68.9	48.8	48.8
Total	100	100	100	100

* Projected.

Source: Panko [1984a], p. 207.

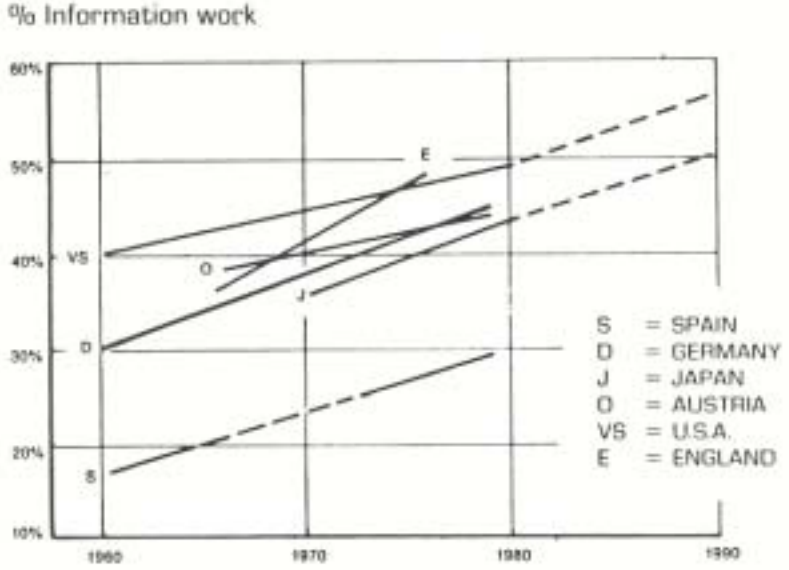

Fig. 4. Percentage information work related to the total labor force.

Source: Fransen [1983], p. 10.

White-collar work now predominates in most companies and will continue to do so throughout the foreseeable future [Panko, 1984a]. Thus concern about productivity improvement is shifting, and must continue to shift, to the now predominant white-collar workforce.

We are here concerned with the issue of productivity as it now applies to a newer style of workforce. In looking to literature on this subject one finds a number of terms used to define and partition the broad term 'white-collar workforce'. Unfortunately the terms used are not at all clear. This chapter, therefore, is devoted to arriving at a clear, useful, and generally acceptable set of workers categories under the very broad classification of white-collar work.

3.1. Office work as a subset of white-collar work and information work

Prior to 1983, the US Bureau of Labor Statistics used a standard occupational classification system that broke the whole workforce into white-collar, blue-collar, service, and farm workers. It included nearly all office workers in the white-collar category, but also some workers who clearly were not 'office workers'. Thus white-collar work and office work, while similar occupational categories, are not synonymous. Table 2 provides some quantitative measure of distribution of participants. After subtracting the 'non-office workers', the office workforce is shown to be approximately 70 percent of all white-collar jobs.

Unfortunately, much of the literature and statistics on worker productivity has confused the definitions of office and white-collar work. Thus many incongruent figures appear in the literature of office automation. According to Panko [1984a],

Table 2
White-collar work vs office work, 1983

Category	White-collar		Office work	
	Employment (thousands)	Percent of employment	Employment (thousands)	Percent of employment
Total employment	99,526		99,526	
White-collar total	53,470	53.7	38,311	38.5

Source: Panko [1984a], p. 208.

the popular statistic that 50% of the workforce are office workers is directly equated with white-collar work. This, as we have seen, is not appropriate.

Beginning in January of 1983, the US Bureau of Labor Statistics introduced a radically different taxonomy for occupation. Figure 5 compares what is included in these broad categories of the old and new systems.

Broadest groupings

NEW	PRE-1983
Managerial and professional specialty	White-collar
Technical sales, and administrative support	Blue-collar
Service	Service
Precision production, craft, and repair	Farm
Operators, fabricators, and laborers	
Farming, forestry, and fishing	

Major occupational groups

NEW	PRE-1983
Executive, administrative, and managerial	Professional and technical
Professional specialty	Managers and administrators, except farm
Technicians and related support	Sales
Sales	Clerical
Administrative support, including clerical	Craft and kindred
Private household	Operatives, except transport
Protective service	Transport equipment operatives
Service, except private household and protective service	Non-farm laborers
Precision production, craft and repair	Private laborers
Machine operators, assemblers, and inspectors	Private household
Transportation and material moving	Other service workers
Handlers, equipment cleaners, helpers and laborers	Farmers and farm managers
Farming, forestry, and fishing	Farm laborers and supervisors

Fig. 5. Occupational classification systems.

Source: Panko [1984a], p. 211.

Table 3
Information work vs office work, September 1983

Category	Information		Office work	
	Employment (thousands)	Percent of employment	Employment (thousands)	Percent of employment
Total employment	102,366		102,366	
All information worker categories	55,475	54.2	40,758	39.8

Source: Panko [1984a], p. 212.

Under the new system the two broadest groupings (managerial and professional specialty; technical sales and administrative support) form a substitute for white-collar work. The Bureau of Labor Statistics has no official name for this pair. Panko proposes they be called 'information work' and suggests they serve as a definition for information work. Table 3 compares information work with office work.

At this point it can be concluded that:

- White-collar work is not equivalent to office work.
- Information work is not equivalent to office work.
- Office work is a subset of both white-collar work and information work.

Apart from the white-collar workers, information workers, and office workers, yet another category finds its way into the office automation literature: the knowledge worker.

3.2. Knowledge work

According to Packer [1985], the term 'knowledge work' refers to non-repetitive, largely unstructured work that requires the exercise of substantial independent judgement and has information processing as an essential component. It should be distinguished from jobs entailing repetitive tasks (e.g. many clerical and assembly-line jobs) or tasks which may require great skill but relatively little judgement, or again from tasks which do not focus on information as an essential ingredient.

According to Conn [1984], white-collar workers include knowledge workers plus clerical and secretarial workers: "Just as the blue-collarworker is easily distinguished from the white-collar worker, so too is the knowledge worker distinguished from the generic white-collar worker. This difference lies in the distinct characteristics of the knowledge worker's job." In his article "Improving use of discretionary time raises productivity of knowledge workers in the offices", Conn [1984] presents a list of individual and group characteristics that distinguish the knowledge workers from other categories of workers. Assuming that the 'knowledge worker' could adequately be defined, it is justified to raise the question: "What occupational categories make up the knowledge worker popula-

tion?" The only easily available figures originate from a Booz, Allen & Hamilton study on the US knowledge worker population [Poppel, 1983]:

59% – non-managerial professionals
28% – lower- and middle-level managers
13% – senior managers

These percentages are based on a study among fifteen representative large US organizations and reflect the distribution of the knowledge worker population and not the size of the group. If it would be possible to define the knowledge worker occupational categories one would finally be able to address the following questions:

- What percentage of knowledge workers consists of information workers?
- What percentage of knowledge workers consists of office workers?

After all, if it's impossible to determine the knowledge worker population, how can that population's productivity be measured or improved?

4. Towards more precise definitions and measures of office productivity

This chapter attempts moving forward the state-of-the-art by developing a more workable definition and measurement of office productivity. Managers have begun to realize that it is in offices that the basic decisions are made which determine the cost-effectiveness of an entire organization. If the office is ineffective, the organization must be ineffective [Giuliano, 1982]. But the nature of offices varies from organization to organization. Different authors thus describe different offices. Here an attempt is made to develop a meaningful definition of the office of today.

4.1. The office of today – a search for a meaningful definition

Realizing the rising importance of the office workforce, one would like both to quantify and to qualify more precisely the meaning of the term "office". In order to do so, one can take a number of points-of-view:

- functional [Blank, 1983]
- task (activities) [Conrath et al., 1984; Harris & Brightman, 1984]
- type (of work) [Panko & Spraque, 1982; Reichwald, 1984; Picot & Reichwald, 1984; Panko, 1984b; Panko & Spraque, 1984]

Panko & Spraque's typology of office work is especially promising for analyzing the office of today. In their article "Toward a new framework for office support", Panko & Spraque [1982] present two basic types of offices: type I and type II.

Type I offices handle routine information processing chores, such as accounting, payroll, billing, check processing and reservation systems. These are essentially paperwork assembly lines. They are staffed primarily by clerical workers, and work is heavily proceduralized and stable over time. Type I offices perfor-

Table 4
A taxonomy of office work

Office work	
Type I offices	Type II offices
flow offices	executive offices
batch offices	line offices
custom offices	professional offices

(Panko & Spraque [1984], p. 42).

mance is usually measured in terms of *efficiency* (doing more with fewer workers) and cost.

Type II offices, in contrast, handle non-routine information processing functions. Examples are line managers offices, legal departments, and staff management groups. Work in these offices changes constantly and procedures are normally loose. Most of the workers in these offices are managers and professionals with secretarial support. Performance in type II offices is normally measured in terms of *effectiveness*, which means doing the right things and achieving goals. Although effectiveness is the main goal of type II offices, efficiency still has its place [Panko & Spraque, 1984]. Panko [1984b] develops this theme further and offers a more descriptive taxonomy of style (table 4).

As one would guess, the unstructured type II offices (executive/line/professional offices) present major problems to the designers and analysts of the office, and particularly with regard to office productivity measurement. We shall now look at the feasibility of how office productivity can be measured, within the framework of a workable definition of office productivity.

4.2. Office productivity – a search for a workable definition

As we have seen, type I offices are essentially paperwork assembly lines. They are characterized by high volumes of transactions and most of the output is readily definable. This offers an opportunity to use the traditional definition of productivity. Specifically, this refers to measures of output and input that are based primarily on physical units: units of products (transactions) in relation to an input factor such as labor hours. Type II offices, however, are characterized by non-routine information handling. This makes definition of their output very difficult. Thus the traditional definition proves inappropriate to type II offices.

According to McDonald & Conrath [1985], the traditional definition of productivity considers only efficiency aspects of productivity ("Are we doing things right so that more is produced with the same or fewer resources?") and ignores the effectiveness aspects ("Are we doing the right things?"). They propose a measure of total office productivity which considers both efficiency and effectiveness. Specifically, they offer a formula as a general descriptive of total office productivity (fig. 6).

The factors involved in their expression require some elaboration:

Total office productivity:

$$\text{Productivity} = \frac{\sum_i (N_i \times Q_i \times T_i \times W_i)}{\text{Total costs}}$$

Where "i" goes from one to the total number of different outputs
N_i = quantity of output "i"
Q_i = weight of the quality factor for output "i"
T_i = weight of the timeliness factor for output "i"
W_i = weight to change to dollars the value of output "i"

Fig. 6. Total office productivity.

Source: McDonald & Conrath [1985], p. 8.

– *Outputs*. The outputs are multi-dimensional, having both dimensions of efficiency and effectiveness. The efficiency dimension is the quantity or numbers of outputs. The effectiveness dimension consists of its quality and timeliness.

– *Quality*. This is the degree to which a product or service conforms to a set of predetermined standards. These are related to those characteristics that determine its value to the recipients and the degree to which its performance satisfies the functions for which it was intended.

– *Timeliness*. This is the degree to which a product or service is provided when needed to render a decision, to complete an operation, or to fulfill an external obligation.

– *Input*. This is the total cost (in constant dollars) necessary to produce the output [McDonald & Conrath, 1985].

Finally we've arrived at a workable definition of office productivity which considers both efficiency and effectiveness factors needed to measure office productivity of both type I and type II offices. The following paragraph includes a discussion of how each of the above-mentioned factors can be measured.

4.3. The measurement of office productivity

Attempts at productivity measurement in offices are not a new phenomenon. Many methods have been developed and used to measure office productivity:

- time expenditure analysis
- time and motion studies
- office procedure flowcharting
- activity or work sampling
- universal office controls
- value analysis [Maynard et al., 1960; British Institute of Management, 1970; Packer, 1981; Lehrer, 1982]

Most of these clerical work measurement techniques have been grounded on industrial engineering principles. Broadly defined, the function of industrial engineering is to bring together people, machines, materials and information to facilitate an effective operation [Saunders, 1982]. According to Olson [Office administration and automation, 1983], however, "industrial engineering tech-

niques belong in the plant, not in the office. For the past several decades, industrial engineering techniques were a common approach to office productivity problems. These techniques center around the measurement of the individual employee. They are given popular (or, depending on your point of view, not so popular) names such as work measurement, work management, short interval scheduling etc. They depend on the proposition that low office productivity is an employee problem: therefore they feel that within the employee should reside the solutions to the problem. These techniques have not been accepted by the employee and therefore lack durability."

If industrial engineering techniques prove to be useless for measuring office productivity, which other method(s) is (are) available and usable? After having reviewed the currently available methods of measuring office productivity, McDonald & Conrath [1985] concluded "that no methodology exists as yet to measure office productivity in a comprehensive way. Either the qualitative aspects of the output are not taken into consideration or they are not combined with quantitative factors." As we have seen, McDonald & Conrath [1985] have developed a measure for total office productivity (fig. 6). This formula includes such factors as output, quality, timeliness and input. In what follows, the measurement aspects of these factors will be discussed:

– *Outputs*. Following a procedure suggested by Mundel, office outputs can be identified by means of hierarchical delineation of the *objectives* of an organization. This is continued through lower and lower levels until convenient-sized outputs, which are produced for use outside the organization, are obtained. Once the outputs are identified, a counting system can be installed at the place where the outputs leave the boundaries of the organization [Mundel, 1983a; Mundel, 1983b].

– *Quality*. The ultimate judge of quality is the recipient of the end-products of the organizational unit. Quality can be measured by subjective judgements from the product recipients. Following this reasoning each recipient of the output can be asked to rate the quality of the output by means of a score. The recipient judges the quality according to a set of predetermined standards related to its value and performance of the function for which it was intended. A score of 100 is assumed to be a standard score. The quality weight can therefore be computed by:

$$Q = \frac{\text{Quality score of recipient}}{100}$$

If several recipients receive the same type of output, the mean value of their score can be used in the formula mentioned above.

– *Timeliness*. Timeliness is the degree to which output is provided when needed. If output is provided on time, that output should receive a score of 100. Output received late earns a lower score and output received early could earn a higher score. The timeliness weight can then be computed by:

$$T = \frac{\text{Timeliness score of the recipient}}{100}$$

According to McDonald & Conrath: "So far we have indicated how to obtain the quantity, quality, and timeliness weights for each type of output. Next the different outputs must be aggregated. The outputs are, however, most often not of one kind and, because we cannot add dissimilar things the outputs must be weighed in some fashion. In our formulation the outputs are divided by cost and therefore cost data should be used as weights."

– *Input*. Total cost i.e. capital costs (including all costs incured for office support systems) and labour costs. These costs should all be obtainable from the administration department.

At the end of their article, they offer some hypothetical examples to illustrate the effect of efficiency and effectiveness factors on the productivity calculation. In the future, however, some operational examples will be needed to prove the credibility of the developed measure and measurement method.

Other recent approaches regarding measuring productivity in an office environment include:

1) Packer [1985]. Packer proposes an integrated approach for measuring effectiveness of knowledge workers. He presents a methodology which relies upon quantitative analysis of subjective output measures.

2) Gutek et al. [1984]. In their study on the implementation of computer-based information technology in 55 offices, Gutek et al. developed a method to measure office productivity. This method is based upon self-reports, and measures perceived productivity changes in offices.

3) Folkers [1985]. Folkers has expanded Tapscott's conceptual model of "the office and the organization as a whole" into a five-layer model. Folkers' model includes methods which are appropriate for measuring productivity on different levels of an industrial organization, including offices.

4) CPI (= Dutch Productivity Center)/Tilburg University. Both are developing research programs to measure productivity, which includes a program for measuring office productivity [Wentink, 1984].

At this point it can be concluded that the state-of-the-art of developing office productivity measurement methods is an area of unfinished business. More developments regarding office productivity measures and measurement will increasingly be needed.

5. Conclusions

– Productivity must be measured if it is to be improved. Today, the definition and measurement of productivity at the national and organizational level must be judged as an art in evolution. Recently, however, a lot of attention has been paid to the so-called productivity measurement crises. A few promising attempts have been made to develop useful productivity measures and measurement methods. Hopefully this trend will continue.

– In the near future, one of the concerns of industrial and organizational psychologists will be the improvement of productivity. Today, the major oppor-

tunities for productivity improvement often lie outside the production function—in 'support' activities and in offices. Often, the greatest gains can be achieved by improving the way in which parts of an (office) organization work together. Psychologists are equipped with methods and expertise to contribute to the process of productivity enhancement. The increasing need for office productivity improvement offers an opportunity to expand the existing methods and, therefore, will probably have a positive impact on employment opportunities for industrial and organizational psychologists.

– In order to measure office productivity at the national level it will be necessary to distinguish between the different types of non-factory work: white-collar work, information work, office work and knowledge work. At the moment the definitions of the different types of work are both vague and intertwined. Panko [1984a,1985] has made an attempt to clear this situation, but still much work must be done at the basic level of terminology.

– Everybody wants to improve the productivity (= efficiency × effectiveness) of office workers, but nobody seems to know how. The biggest problem is the development of a workable definition and the complementary measurement tool. Recent attempts to overcome this unpleasant situation include the development of a methodology for measuring total office productivity. This methodology considers both the effectiveness (quality and timeliness) and efficiency aspects of productivity measurement. Although this method can be considered as the first real attempt to measure productivity in a comprehensive way, much work must be done to operationalize the given methodology.

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D = Dutch
G = German