

Marian HOPEJ\*,  
Janusz MARTAN\*\*

## THE DETERMINATION OF SPAN OF CONTROL

In this article, an attempt has been made to compare two methods of determining potential span of control, that is, the Stieglitz method and the Graicunas method. It appears that the application of those two approaches leads to similar ramifications. They both have essential failures, which fact leads to the conclusion that new and improved methods for determining the optimal number of subordinates for a given manager must be sought. This results in the more effective decision-making processes.

Keywords: *Stieglitz method, Graicunas method, span of control, number of subordinates*

In the science of organization and management, three types of span of control can be distinguished, namely, potential, formal and real span of control. Potential span of control is the number of subordinates a manager can effectively manage in given conditions. Formal span of control refers to the number of people directly and formally (in formal organizations) subordinate to a manager. Real span of control, on the other hand, measures the number of subordinates who in fact directly report to the manager [Kieżun, 1999], [Pszczółowski, 1978], [Zieleniewski, 1974].

Some significant discrepancies may appear between the above-mentioned spans of control. When potential span of control is bigger than formal and real ones, the manager has the feeling that he does not have enough work to do. When formal and real spans of control are bigger than potential one, the manager is not able to formally and really supervise the subordinates. Some of the employees may get out of his influence and an informal deputy manager may even emerge. Hence, real and formal span of control should agree with potential span of control [Hopej, 2005].

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\* Institute of Engineering and Management, Wrocław University of Technology, ul. Smoluchowskiego 25, 50-372 Wrocław, e-mail: marian.hopej@pwr.wroc.pl

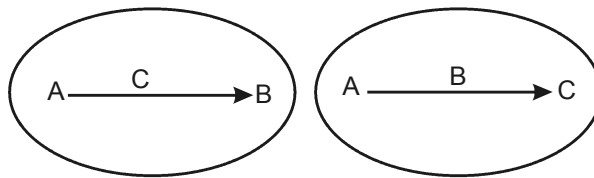
\*\* Institute of Applied Information, Wrocław University of Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, e-mail: janusz.martan@pwr.wroc.pl

In theory and practice four methods of calculating potential span of control are known. They are as follows: analogy, intuitional, mathematical and factorial method [Kiežun, 1997].

According to the oldest Old Roman sources the rule of the ten-person span, constituting the basis of the organization of the legions, was based on the analogy of the number of fingers. Napoleon, who was widely known for keeping one of his hands in his breast pocket, was in favour of the five-person span, whilst H. Fayol intuitively determined the potential span of control to be 15 [Kiežun, 1997].

Graicunas, on the other hand, followed a different path and distinguished three types of relationships between superior and subordinates:

- Direct single relationships between superior and individual subordinates. The number of possible direct individual relationships therefore equals the number of subordinates  $n$ .
- Direct group relationships. Graicunas assumes that in contacts between a superior and a group of subordinates, one of the subordinates comes always to the fore. This means that in case of two subordinates (B, C), there are two groups BC and CB (Fig. 1).



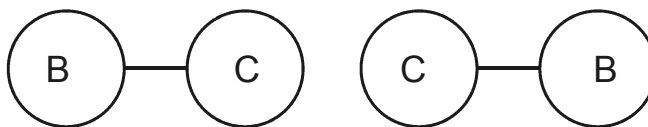
**Fig. 1.** Relations between superior and a group of subordinates  
The following is taken from the author's own research

Hence, the total number of relationships amounts to:

$$X = n(2^{n-1} - 1) \quad (1)$$

where  $X$  is the number of interrelationships between the superior and his subordinates and  $n$  is the number of subordinates.

- Relationships between subordinates, which absorb the manager's attention. Only pairs with one person as an initiator were taken into consideration (Fig. 2).



**Fig. 2.** Relations between the subordinates  
The following is taken from the author's own research

The number of interrelationships between the subordinates can be calculated from the formula:

$$Y = n(n - 1) \quad (2)$$

where  $Y$  is the number of relationships between subordinates and  $n$  is the number of subordinates.

If we add all the types of relationships, we can calculate their total number  $Z$  from the formula:

$$Z = n + n(2^{n-1} - 1) + n(n - 1) = n(2^{n-1} + n - 1) \quad (3)$$

It follows from the formula that each rise in the number of subordinates by one more than doubles the number of possible interrelationships. With three subordinates the number of interrelationships is 18, with four it is 44, five bring the total up to 100, whilst six make a total of 222.

Graicunas' idea is often referred to, especially by Polish authors, as an example of basic mistake. "One cannot find two identical, addable social interactions, identical managers, subordinates or organisational situations. Therefore, the determination of potential span of control cannot be the result of abstract analysis but it should result from the study of many interrelated factors" [Koźmiński et al., 1995].

Consequently, it is generally assumed that the determination of potential span of control must be the result of the study of various factors. Polish author Zieleniewski distinguished two groups of factors which influence the number of subordinates who can be directly and adequately managed. The first group comprises:

- the complexity of the decisions made by the manager and connected with it, the necessary time needed to prepare and make decisions,
- the load on the superior with non-managerial activities (executive ones),
- the load on the superior with external contacts.

The second group consists of:

- the abilities of superiors and the resulting degree of their independence in decision making and undertaking their actions,
- the amount and nature of interdependence between subordinate posts or organisational units and spatial spread of subordinates,
- the complexity and repeatability of actions taken by subordinates.

As emphasised by the above mentioned author, the more time the superior must spend on contacts with subordinates, the bigger the potential span of control. These contacts, on the other hand, become less time consuming as the abilities of the subordinates grow, relationships between the positions become weaker, the spatial spread shrinks and the activities of the subordinates become more routine [Zieleniewski, 1974].

Another attempt to determine the potential span of control is the Stieglitz method, favourably evaluated because of the possibility of its practical application. It is based

on the assumption that span of control depends on seven factors, for which “values” were established, according to common sense and experience (Table 1).

**Table 1**

The degree of the load on the superior as a function of the intensity of the factors of potential span of control

Factor	The degree of the load on the superior				
	Identical	Strikingly similar	Similar	Fundamentally different	Completely different
The similarity of the functions	1	2	2	4	5
Spatial spread of subordinates	all together	all in one building	on the premises	spread in the city	spread in a country
	1	1	2	4	5
The complexity of functions	Simple, recurring	Routine	Complicated	Very complicated	Very complicated and diverse
	2	4	6	8	10
Staff qualifications	minimum of hints and control	limited supervision	periodical supervision and control	frequent systematic control	frequent systematic and strict control
	2	6	9	12	15
Coordination	minimum contacts	limited contacts	more contacts, easy coordination	permanent contacts in case of serious problems	broad unrepeatable contacts
	2	4	6	8	10
Planning	minimum	limited range	bigger range	considerable range	wide range exclusively for politics
	2	4	6	8	10

Taken from J. Jaszek 1984, p. 176.

Next, on the basis of empirical-contrastive analysis the number of subordinates was assigned to point ranges which describe the influence of selected factors on the number of subordinates, constituting the potential span of control (Table 2).

**Table 2**

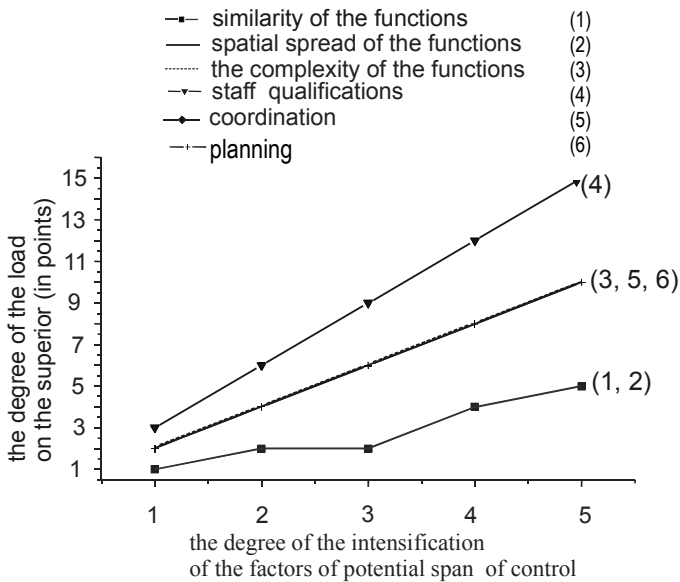
The load on the superior as a function of the number of subordinates

Load in points	40–42	37–39	34–36	31–33	28–30	25–27	22–24
The number of subordinates	4–5	4–6	4–7	5–8	6–9	7–10	8–11

Taken from J. Jaszek, 1984, p. 175.

The theories described above are independent; there is no mention of their inter-relationship in the related literature. It would be interesting to present the load on the superior as a function of the number of relationships between superior and subordinates; in other words, it would be interesting to link the Graicunas theory with the Stieglitz theory.

Figure 3 shows the relationships between the degree of the load on the superior as a function of the degree of intensification of the factors of potential span of control, for six of the factors proposed by Stieglitz. As easily noticed, the relationships under consideration are linear functions and can be approximated by analytical formulas.



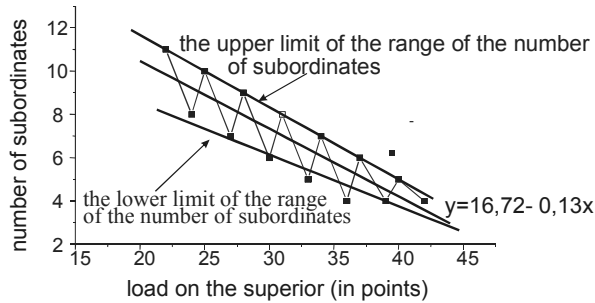
**Fig. 3.** The impact of the degree of intensification of the factors of potential span of control on the load on the superior  
The following is taken from the author's own research

In Figure 4, the impact of the number of subordinates on the load on the superior (graphical interpretation of Table 2) for two extreme numbers of subordinates is presented.

The relations presented in Figure 4 were approximated by a straight line

$$n = 16,72 - 0,312 \cdot x \tag{4}$$

where  $n$  is the number of subordinates and  $x$  is the load on superior.



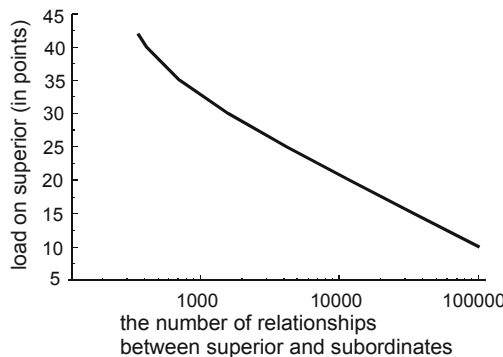
**Fig. 4.** The impact of the number of subordinates on the load on superior  
The following is taken from the author's own research

Putting the above expression into the Graicunas formula, we get the impact of the number of relationships between superior and subordinates on the degree of the load on the superior (see Figure 5) expressed analytically by the formula

$$F = 16,408 \cdot 2^{15,72 - 0,312 \cdot x} + 257,94 \tag{5}$$

where  $F$  is the number of relationships between the superior and subordinates and  $x$  is the load on superior.

The relationship analysed is of exponential character, which means that even a small change in the number of relationships between superior and subordinates influences in a fierce way the degree of the load on the superior. As one can see, the attempt to link two allegedly unrelated theories was successful.



**Fig. 5.** The impact of the load on the superior on the number of relationships between superior and subordinates  
The following is taken from the author's own research

The analysis carried out could have indicated that the criticism of Graicunas' idea is of little legitimacy. It does not do this, however, because it is difficult, if not impos-

sible, to assume that all three types of relationships are of the same significance. Interrelationships should especially be evaluated in a different way than direct relationships. Moreover, the assumption that each attempt to exert an influence on someone absorbs the same amount of time is very doubtful.

Additionally, there are also some doubts concerning the Stieglitz method. One may claim that it does not take into account the greater number of factors, such as time pressure or organisational culture. Furthermore, the way of assigning values to individual factors is also debatable.

Hence, if the application of the Stieglitz method and the Graicunas method leads to similar consequences, none of them should constitute the basis for the determination of span of control in specific organisations. However, it is necessary to determine the span of control, because resulting from the rule of the limited span of control, multidimensional hierarchies are still “the best mechanism we have at our disposal to do a complex work. It would be unrealistic to expect that we will get rid of them in a foreseeable future. The wiser solution would be the acceptance of the fact that hierarchies exist and will always exist, and making an effort to limit their poisonous side effects as well as causing that the life of people in those hierarchies will be better, taking care at the same time of workers’ efficiency” [H.J. Leavitt, 2004, p. 118].

What, is therefore, the way of determining the span of control? We suggest (in broad outline) an approach a little bit different from those most often met in the literature of the subject. In our opinion, span of control is an endless process. This means that in creating an organisational structure, one should, by the use of factorial method encompassing as many factors as possible, determine potential span of control and put the findings into practice. Next, the superior should observe carefully the behaviour of subordinates and listen intently to their needs and problems. Such observation enables the correction of the previously made decision, which may be wrong because of the difficulties with predicting human behaviour.

Therefore, the correcting mechanism is necessary when determining the span of control. This also results from the fact that factors influencing the span of control, because of their dynamic character, undergo frequent changes. As a consequence, it is essential to monitor constantly the implemented solution, verifying its relevance in new, altered conditions [M. Czerska, 1998]. This gives a stimulus to the disclosure of possible need of another change.

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### **Ustalanie rozpiętości kierowania**

W artykule podjęto próbę porównania dwóch metod ustalania potencjalnej rozpiętości kierowania, tj. metody Graicunasa i Stieglitza. Okazało się, że ich stosowanie prowadzi do zbliżonych konsekwencji. Obie metody mają istotne wady i należy poszukiwać innych, doskonalszych metod ustalania właściwej liczby bezpośrednich podwładnych określonego kierownika, co prowadzi do sprawniejszego procesu decyzyjnego.

Zaprezentowany zarys nowej metody opiera się na założeniu, iż ustalenie rozpiętości kierowania jest procesem, który nigdy się nie kończy. Musi być w niego wbudowany mechanizm korygowania, ponieważ ciągle zmieniają się warunki pracy zarówno przełożonego, jak i podwładnych. Istnieje więc w praktyce konieczność stałego monitorowania wdrożonego rozwiązania pod kątem dalszej jego aktualności w nowych, zmienionych warunkach. Daje to asumpt do ujawnienia się ewentualnej potrzeby kolejnej zmiany organizacyjnej.

Słowa kluczowe: *metoda Stieglitza, metoda Graicunasa, zakres decyzyjny, liczba podwładnych*