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The Hierarchical Control Matrix: Exploration of an unfashionable structure

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Abstract

Matrix structures are allegedly adopted by large companies in order to combine dispersed expertise, yet I maintain that sometimes they are introduced in order to obtain greater control. In general, finance provides the additional sheaf for this sort of control matrix.

I support this claim with (*i*) an analysis of the organization charts of the *Forbes 2000* largest companies in the world, and (*ii*) a retrospective reconstruction of the organization charts of three infrastructure planning organizations. I suggest that the control matrix can be an effective second-best solution for organizations plagued by directors pursuing local or even personal interests.

Keywords: Organization Structures, Matrix Structures, Large Organizations, Public Administrations, Conflicts of Interest, Olympic Infrastructures

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1 Introduction

Matrix organization structures are characterized by two or several sheaves of lines of command, each of them reporting along alternative dimensions such as functions, products or regions. One consequence is that the members of matrix organizations end up with having several bosses, one for each of the above dimensions. Thus, matrix structures need clear separation of responsibilities in order to curb conflicts [22], [14], [3].

Matrix structures are generally recommended for organizations that must combine dispersed expertise in order to adapt to ever-changing conditions [24], [13], [10]. However, a different rationale can be found in the history of the Soviet Union, which in economic terms was a large monopolist that encompassed a whole national economy [15]. This monopolist had a matrix structure, yet not in order to combine dispersed expertise [19].

The difficulty to manage such a large organization induced the Soviet leaders to add a second and then a third line of command to the State administration, namely the Communist Party and the secret services, respectively. Notably, this three-dimensional matrix was introduced for the purpose of exerting control rather than combining dispersed expertise. Henceforth, I shall call this structure hierarchical control matrix or, more succinctly, control matrix.

My first research question is whether at least partial control matrices exist in capitalistic enterprises, particularly the largest ones [4]. The second is whether finance, as suggested by Galbraith [13, p. 7], is likely to be used as an additional command line. Finally, what advantage(s) the control matrix provides. Specifically, I hypothesize that in large organizations plagued by directors pursuing local or even personal interests the control matrix can be preferable to direct intervention and micromanagement.

In the ensuing section I analyze the organization charts published by the largest companies in the world. In the subsequent section I analyze infrastructure construction for three international sporting events. Finally, managerial implications conclude.

2 Company Charts

I observed the charts published by the world's 2,000 largest companies on their web sites [12].[1] While organization charts generally depict hierarchical relations, I also included charts that described the flow of activities between organizational units, as well as those that illustrated ownership quotas within conglomerates.

Out of a total of 782 charts, only 21 (2.7%) exhibited a full-fledged textbook-matrix covering the whole organization — notably, one of them made clear that that matrix had been introduced to exert greater control, not in order to combine scattered expertise [16]. By contrast, duplication of control paths in small portions of the organization occurred more often.

[1] I only considered organization charts that had been published on company web sites, that were neither meant for the popular press (with pictures of managers) nor for regulatory agencies in order to go public, that were sufficiently complex to depict more than three levels, that did not exclusively concern CSR, EHS, Sharia or other special issues, that were not limited to subsidiaries or divisions of larger companies and that did not depict radial structures or inverted hierarchies. A fraction of companies published several charts, generally of different types.

	Hier. Chrt	Act. Flow	Own. Str.	TOT
Matrix	21	–	–	21
Fn. DC	51	55	24	130
o. DC	16	–	–	16
No DC	394	166	55	615
TOT	482	221	79	782

Table 1: Full-fledged matrices and structures with limited usage of double controls (DC). Financial DC at high hierarchical levels (130), other DC at any level (16).

I focused on finance-based double controls [13, p. 7] and, in order to exclude the most routinized sort of internal auditing, I limited my analysis to financial double controls that checked — among others — a company's chief officers. A total of 130 out of 782 charts (16.6%) entailed finance-based such double controls. By comparison, non-financial double controls amounted to a mere 2%. Table 1 summarizes these results.

I take these double controls as an indication of the existence of a finance-based control matrix in limited portions of a non-negligible minority of companies. Figure 1 illustrates one instance from the particularly clear case of ownership charts.

3 A Retrospective Case Study

The need to exert greater control arises quite often in public administrations and State-owned companies [5] [6]. In particular, the *ad hoc* organizations that are eventually set up to contract out the construction of infrastructures for big sporting events face a particularly challenging task [21]. Since these organizational efforts are documented by national laws, whereas their relative success is openly discussed in the popular press, they provide a unique opportunity to observe whether any control matrix has been employed.

In particular, I analyzed the administrative structures that have been put in place in Italy in order to coordinate the construction of infrastructures for three big international sporting events, namely the 1990 World Football Championship (henceforth, *Italia '90*), the 2006 Turin Winter Olympics (henceforth, *Torino 2006*) and the Winter Olympics scheduled to take place in 2026 in Milan and Cortina D'Ampezzo (henceforth, *Milano-Cortina 2026*).

Among these three events, *Italia '90* stands out as a paramount example of poor usage of public money in the Italian popular press [17]. The analysis of the laws that regulated the allocation of funds reveals why.

Firstly, the whole decision process started too late to be efficient. Legislative activity began in 1987, just three years before the event, hence it was based on emergency decree-laws [26], [28] that were later turned into regular laws [27], [29] that required subsequent clarifications in their turn [30]. In order to save time, Government removed all regulators that checked — *inter alia* — consistency of expenditures with infrastructure size. As illustrated in the upper portion of Figure 2, according to the 1987

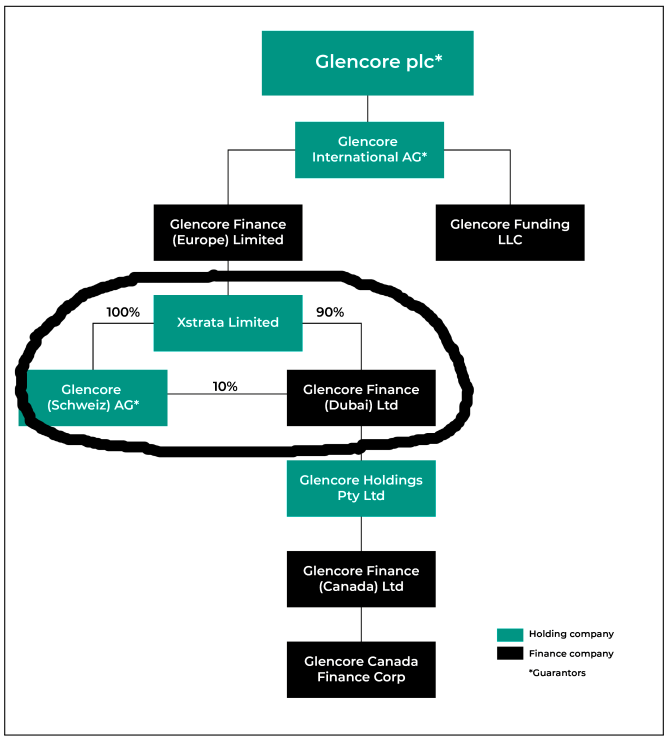

Figure 1: An ownership chart with a double path to one component company. Specifically, *Glencore Finance (Dubai)* depends on both *Glencore Schweitz* and *Xstrata Limited*, although all of them belong to *Glencore*. By courtesy of Glencore International ©.

law [26], [27] any proposal for the construction of infrastructures presented by any city council was automatically financed by Government, which even permitted private agreements with contractors to bypass regular public auctions. In practice, the quality of expenditures depended on whether local governments had assembled a long list of infrastructural projects for which they lacked funding in the previous years, or rather invented projects on the spot in order to make some usage of unexpected funds [18].

By 1989, funds misallocation had become evident. Government attempted to reintroduce some degree of regulation by exerting direct control over the proposals that it was receiving [28], [29], but the Parliament and Government bodies that had to carry out such controls were not sufficiently staffed to observe the real state of affairs. The ensuing structure, illustrated at the bottom of Figure 3, reflects this attempt at micromanagement.

The control matrix came with the *Torino 2006* Olympics. This time, the organizational structure was devised six years before the event and approved with regular laws [31], [32].

An Infrastructure Planning Body (IPB) was created with the specific purpose of selecting contractors and checking execution. The IPB was subordinated to national and regional Government but enjoyed a substantial degree of autonomy. Regulations were eased but not abolished, making the IPB accountable.

A second line of control was provided by an independent authority provided with adequate funding, the High Surveillance Committee (HSC). While the HSC was initially foreseen to operate with members expressed by the national Government and local governments in equal proportions [31], three years later [32] the balance was reversed in favor of the national Government. Figure 3 illustrates this second structure on top, with a dotted line from regional government to the HSC reflecting lack of influence.

Notably, *Torino 2006* has not been immune from mismanagement. In particular, the popular press has been keen to emphasize the needless construction of a bobsleigh track although one was available in neighboring *La Plagne* (France). National Government imposed the construction of a brand-new refrigerated track for nationalistic reasons [8], a circumstance that shows that even the control matrix is not a solution if the controlling agent has objectives other than efficiency.

A sense of urgency surfaced again with the *Milano-Cortina 2026* Winter Olympics, based once again on decree-laws [33], [34], [35]. Moreover, *Milano-Cortina 2026* involves two regions, two autonomous provinces, several regular provinces as well as the mayors of the two cities of Milan and Cortina in major decisions.

Also in the case of *Milano-Cortina 2026* an IPB has been devised, but its decision-makers have been appointed by five actors: The national Government, two regions, and two autonomous provinces. Most importantly, this administrative body is being regulated by the same norms that apply to public administrations, which imply less delegation than was the case for *Torino 2006*. In Figure 3, I made clear this difference by connecting this body to the national Government by means of two arrows instead of one.

Formally, double control appears to be in place also for *Milano-Cortina 2026*. However, the Joint Olympic Council (JOC) is dominated by local governments and, most importantly, it has not been funded. Remuneration of its members has been ex-

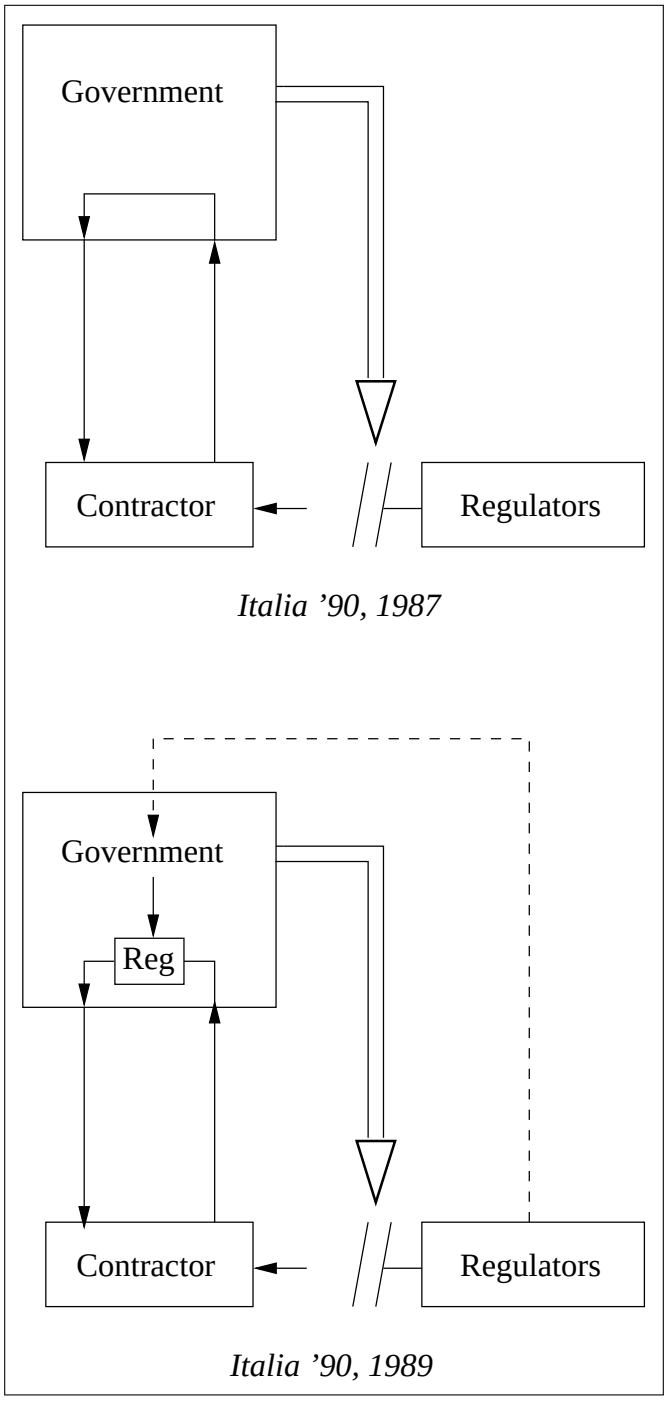

Figure 2: Top, the structure that enabled unlimited expenditures in the initial phase of *Italia '90* [26], [27]. Government made regulators ineffective in order to speed construction (big arrow severing the linkage from regulators to contractors). Bottom, the structure that later on attempted to introduce some regulation at the top by transferring a fraction of the competencies of institutional regulators to Government (dotted arrow from regulators to Government) [28], [29], [30]. This small centralized regulatory agency was staffed with 5 persons only. The dashed arrow is meant to express its limited effectiveness.

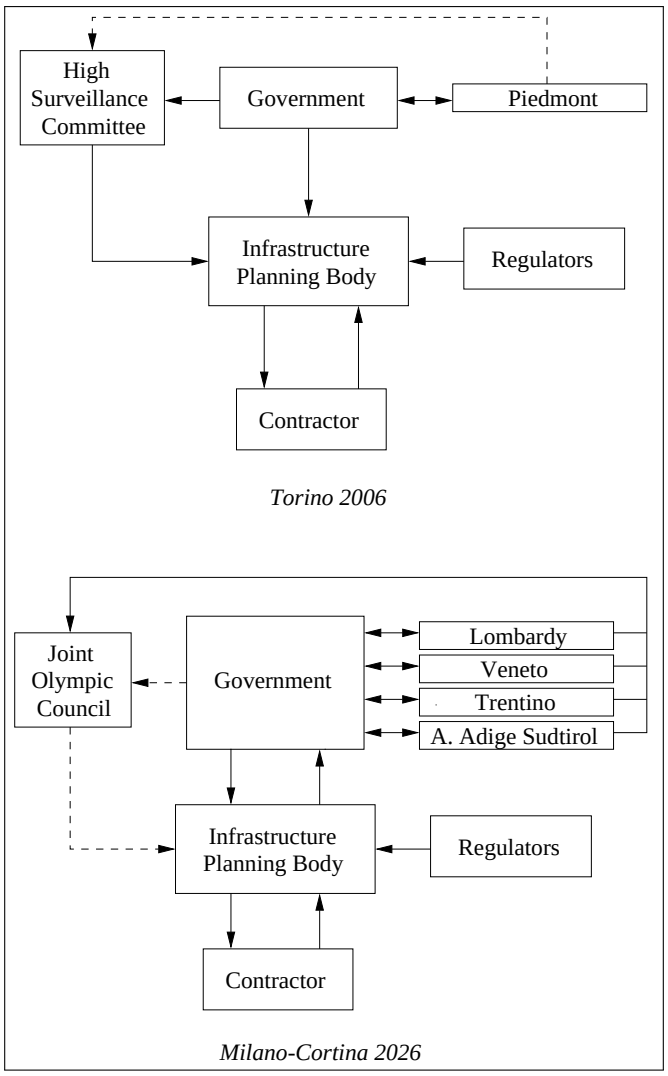

Figure 3: Top, the structure that governed the selection and execution of infrastructures for *Torino 2006*. Bottom, the structure that is governing the selection and execution of infrastructures for *Milano-Cortina 2026*. The double arrows between Government and the Infrastructure Planning Body in *Milano-Cortina 2026* signify that far less delegation, far more micromanagement is taking place in comparison to *Torino 2006*. The dashed double controls of *Milano-Cortina 2026* signify that they are limited by lack of funds and prevalence of local governments in the JOC. By contrast, the regional Government of Piedmond had a weak influence on the HSC (dashed arrow) whereas the regional Governments of Lombardy, Veneto, Trentino and Alto Adige / Südtirol had a strong influence on the JOC.

plicitly prohibited. In Figure 3 I depicted the double control through the JOC with dotted arrows to express the belief that the JOC is unlikely to be effective.

Note also that the double controls that effectively checked *Torino 2006* (upper-left portion of Figure 3) form a short loop just like that of Figure 1. This loop has been weakened in *Milano-Cortina 2026*, where the loop through which local governments (Lombardy, Veneto, Trentino, Alto Adige / Südtirol) could influence the JOC has been strengthened in comparison to Piedmont's ability to influence the HSC.

In 2024, *Milano-Cortina 2026* was late in realizing the required infrastructures. The popular press highlighted that substantial sums of money had disappeared [11], [23], [25].

Government reacted with two decrees. The first one specifies which infrastructures must be built by which deadline [36]. The second one diverts responsibility for all transportation infrastructures to the national agency for road construction (ANAS) and nominates new managers for the IPB [37]. Government officials have publicly admitted that some sport infrastructures will only be ready *after* the Olympics [20].

These measures testify to an increase of micromanagement, which from the outset was greater for *Milano-Cortina 2026* in comparison *Torino 2006*. At so late a stage, the quick logic of micromanagement was likely preferable to the slower mechanism of double control.

4 Managerial Implications

This research was triggered by a confidential statement by the CEO of a large European company, who explained that he had introduced a matrix structure to curb the drive of divisional directors to exert unrestrained power over their own turf. I found this statement extremely interesting because it was so different from the received wisdom.

The managerial literature ignores the control matrix, except for the Soviet case [19]. It is unrelated to innovation and its hierarchical design is unfashionable, but it should be compared to micromanagement rather than flexible and collaborative organizations. If directors pursue local or personal goals and a CEO seeks additional levers [9], then the control matrix can be a more effective, more viable alternative to extreme formalization and extensive micromanagement. However — as the *Milano-Cortina 2026* example made clear — it takes longer than micromanagement and is therefore inappropriate in emergency situations. Table 2 summarizes these considerations.

Contrary to matrix structures designed to combine dispersed expertise, the control matrix does not rely on separation of competencies and minimization of conflicts. All the opposite. The control matrix works by generating conflicts, and therefore any two (or more) directors placed in competition with one another should ideally have overlapping competences [7]. Precisely the drawback that a matrix structure designed to combine dispersed expertise seeks to avoid, this becomes for the control matrix a plus.

The universality, generality and effectiveness of finance makes it the ideal candidate to exert double control [2]. I limited my analysis to high hierarchical levels in order to curb the influence of spurious data, but it is the discretion in the extent, focus and continuity of financial checks that makes the difference between routine practice and

Control Matrix	*Micromanagement*
Requires Careful Planning	Quick Response
Moderate Involvement	Substantial Involvement
Acceptable Complications	Unbearable Strife

Table 2: The control matrix requires careful planning and is therefore inappropriate when a quick response is in order. However, it requires moderate involvement from top managers while generating complications that are acceptable for middle managers. By contrast, micromanagement consumes managerial resources and generates strife to a degree unbearable in the long run.

usage of finance as a management tool. In principle, finance-based double controls can operate at low hierarchical levels just as well.

As the case-study of the Italian infrastructure planning organizations demonstrates, the principles of the control matrix are intuitively known but not always applied. By making this knowledge explicit, the vagaries of discovering it with *Torino 2006* but forgetting it with *Milano-Cortina 2026* may be hopefully avoided.

With this paper I hope to have increased awareness of its advantages among CEOs whose organizations are jeopardized by directors pursuing local or personal goals that conflict with those of the organization [9]. For small contractors of Government agencies and other large organizations, checking that double controls are in place may save unpleasant surprises such as additional requirements and delayed payments [1]. One advantage is that while organizational politics may be only available to a few insiders, structural features are generally made public.

My defense of the control matrix should not be misperceived as its glorification. Awareness of the existence of a second-best preferable to micromanagement is not meant as an excuse for deflecting efforts from building first-best organizations based on collaboration and alignment of individual and collective goals.

Conflicts of interest and legal disclaimers

The author declares not to have any conflict of interest whatsoever with the organizations, institutions and persons directly or indirectly mentioned in this paper. No experiment involving humans or other animals was carried out. This research was not funded.

References

[1] Ebenezer Adaku, Victor Osei-Poku, Jemima Antwiwaa Ottou, and Adwoa Yirenkyi-Fianko. Contractor payment delays: a systematic review of current trends and future directions. *Construction Innovation*, 24(5):1205–1227, 2024.

[2] Anthony J. Berry, Jane Broadbent, and David T. Otley, editors. *Management Control Theory*. Routledge, London, 1998.

[3] Vishal Bhalla, Daniel Gandarilla, and Michael Watkins. How to make your matrix organization really work. *MIT Sloan Management Review*, Strategy(64232), Nov 17th, 2022.

[4] Lawton R. Burns. Management in hospitals: Testing theories of matrix structure and development. *Administrative Science Quarterly*, 34(3):349–368, 1989.

[5] Michel Crozier. *The Bureaucratic Phenomenon*. Chicago University Press, Chicago, 1964.

[6] Michel Crozier and Erhard Friedberg. *Actors and Systems: The politics of collective action*. Chicago University Press, Chicago, 1980.

[7] Falk Daviter. The political use of knowledge in the policy process. *Policy Sciences*, 48(4):491–505, 2015.

[8] Maurizio Dematteis. Castellani racconta la vera storia della pista da bob di cesana-pariol. *Dislivelli*, Dec 15th, 2010. Accessed on March 23rd, 2023.

[9] Joel S. Demski. Corporate conflicts of interest. *Journal of Economic Perspectives*, 17(2):51–72, 2006.

[10] William G. Egelhoff and Joachim Wolf. *Understanding Matrix Structures and their Alternatives*. Palgrave Macmillan, London, 2017.

[11] Luigi Ferrarella. Olimpiadi milano-cortina 2026, corruzione e gare truccate per l'appalto servizi digitali: indagato l'ex ad vincenzo novari. *Corriere della Sera, Milano*, May 22nd, 2024. Accessed on Oct 30th, 2024.

[12] Forbes. Forbes global 2000 list. Available at `www.someka.net/products/forbes-global-2000-list-excel-template`, 2019. Accessed on June 10th, 2020.

[13] Jay R. Galbraith. *Designing Matrix Organizations that Actually Work*. Jossey-Bass, San Francisco, 2009.

[14] Nishan Kishore, Jan Harm Christian Pretorius, and Gopinath Chattopadhyay. The roles of functional managers and project managers in a matrix organization. In *2019 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, pages 784–788, Macao, 2019.

[15] Heidi Kroll. Monopoly and transition to the market. *Soviet Economy*, 7(2):143–174, 1991.

[16] LIXIL. Notice of convocation of the 78th annual shareholders' meeting. Available at `www.lixil.com/en/investor/ir_event/pdf/syousyu20200610.pdf`, 2020. Accessed on Jan 15th, 2022.

[17] Lorenzo Longhi. L'italia di italia '90. *Istituto Treccani Magazine, Atlante, Società*, June 8th, 2020. Accessed on March 22nd, 2023.

[18] Christine Obermair. Italia '90 — eine verpaßte chance der stadtpolitik? In H. Häußermann and W. Siebel, editors, *Festivalisierung der Stadtpolitik*, pages 208–229. VS Verlag für Sozialwissenschaften, Wiesbaden, 1993.

[19] John F. Padgett and Walter W. Powell. *The Emergence of Organizations and Markets*. Princeton University Press, Princeton, 2012.

[20] Giuseppe Pietrobelli. Milano-cortina, il grande ritardo: opere per almeno 2 miliardi di euro verranno terminate solo dopo le olimpiadi 2026. *Il Fatto Quotidiano*, May 24th, 2024. Accessed on Oct 30th, 2024.

[21] Holger Preuss. *The Politics of Staging the Olympics*. Edward Elgar, Cheltenham, 2004.

[22] Zenith Rathore, Ahmed Radwan, and Emad Elwakil. Framework to identify and evaluate the cause of conflicts within a matrix organization in construction industry using fuzzy expert system. In *2015 Annual Conference of the North American Fuzzy Information Processing Society (NAFIPS) held jointly with 2015 5th World Conference on Soft Computing (WConSC)*, pages 1–6, Redmond, 2015.

[23] Monica Serra. Olimpiadi di milano, l'ombra di parentopoli. *La Stampa*, May 23rd, 2024. Accessed on Oct 30th, 2024.

[24] Thomas Sy and Laura Sue D'Annunzio. Challenges and strategies of matrix organizations. *Human Resource Planning*, 28(61):39–48, 2005.

[25] Gianfrancesco Turano. Gli assurdi sprechi delle olimpiadi di milano cortina: tra raccomandati da assumere e denaro pubblico bruciato. *L'Espresso*, May 23rd, 2024. Accessed on Oct 30th, 2024.

[26] Gazzetta Ufficiale. Decreto-legge 03-01-1987, n. 2. Available at `www.gazzettaufficiale.it`, 1987. Serie Generale n. 3 del 05-01-1987.

[27] Gazzetta Ufficiale. Legge 06-03-1987, n. 65. Available at `www.gazzettaufficiale.it`, 1987. Serie Generale n. 55 del 07-03-1987.

[28] Gazzetta Ufficiale. Decreto-legge 01-04-1989, n. 121. Available at `www.gazzettaufficiale.it`, 1989. Serie Generale n. 77 del 03-04-1989.

[29] Gazzetta Ufficiale. Legge 29-05-1989, n. 205. Available at `www.gazzettaufficiale.it`, 1989. Serie Generale n. 126 del 01-06-1989.

[30] Gazzetta Ufficiale. Testo coordinato del decreto-legge 01-04-1989, n. 121. Available at `www.gazzettaufficiale.it`, 1989. Serie Generale n. 151 del 30-06-1989.

[31] Gazzetta Ufficiale. Legge 09-10-2000, n. 285. Available at `www.gazzettaufficiale.it`, 2000. Serie Generale n. 242 del 16-10-2000.

[32] Gazzetta Ufficiale. Legge 26-03-2003, n. 48. Available at www.gazzettaufficiale.it, 2003. Serie Generale n. 74 del 29-03-2003.

[33] Gazzetta Ufficiale. Decreto-legge 11-03-2020, n.16. Available at www.gazzettaufficiale.it, 2020. Serie Generale n. 66 del 13-03-2020.

[34] Gazzetta Ufficiale. Legge 08-05-2020, n.31. Available at www.gazzettaufficiale.it, 2020. Serie Generale n. 121 del 12-05-2020.

[35] Gazzetta Ufficiale. Decreto 07-12-2020. Available at www.gazzettaufficiale.it, 2021. Serie Generale n. 26 del 01-02-2021.

[36] Gazzetta Ufficiale. Decreto 08-09-2023. Available at www.gazzettaufficiale.it, 2023. Serie Generale n. 222 del 22-09-2023.

[37] Gazzetta Ufficiale. Decreto-legge 05-02-2024, n. 10. Available at www.gazzettaufficiale.it, 2024. Serie Generale n. 29 del 05-02-2024.