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Changes in Organizational Architecture: Aspiration Levels, Performance Gaps and Organizational Change

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This paper illustrates how organizations change their architecture in response to environmental feedback, measured in relation to performance gaps. Based on a study of 762 organizations, we explore the modus operandi underpinning architectural change and argue that the interplay between social and historical aspiration levels: (i) constitutes a benchmark against which organizations measure current performance; and (ii) defines the scope of architectural change. While a small performance gap leads organizations to implement minor architectural changes (adaptation strategy), a large performance gap requires major change (reorientation strategy).

Keywords: Adaptation; architectural change; performance gap; reorientation.

1. Introduction

Theoretical and empirical studies show that organizations comprise different elements, whose arrangement defines their organizational architecture [Fjeldstad *et al.* (2012); Gulati and Puranam (2009); Simon (1947)]. Organizations strive to reconfigure their organizational elements in order to increase their fit with the external environment: they modify constituent elements to address new opportunities and respond to new pressures resulting from a changing environment [Kim and Rhee (2009); Lawrence and Lorsch (1986); Milgrom and Roberts (1995); Siggelkow (2002); Yeh and Fang (2011); Zott and Amit (2008)]. The extant literature highlights that external feedback is a major influence on architectural change

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[Bensaou and Venkatraman (1995); Burns and Stalker (1961); Dennis and Meredith (2000); Galbraith (1973); Labianca *et al.* (2009); Snow *et al.* (2005)]. Although it offers valuable insights into the relationship between environmental feedback and architectural change, little is known about the scope of these changes. This paper investigates the extent of changes in organizational architecture prompted by environmental feedback.

The existence of a variety of scope in architectural change is suggested in Siggelkow [2001], which identifies a set of strategic options: (i) playing the old game — i.e. the organization retains the existing configuration; (ii) playing an incomplete game — i.e. the organization changes one or a few elements; (iii) playing a new game — i.e. the organization changes the whole range of its elements. To explain the incomplete game situation, Siggelkow [2001] reports the case of US automotive organizations, which, in the 1980s, observed a gap in their performance compared to Japanese competitors. These organizations had played an incomplete game for many years, by imitating a small number of the elements of the Japanese production system [Hayes and Iuikumar (1988); Siggelkow (2001, p. 842)]. A famous example of a successful "playing a new game" strategy is the transition towards services accomplished by IBM at the beginning of the 1990s. In response to increasing competition, IBM's newly appointed CEO, Louis Gerstner, implemented radical changes to the organization that modified every element of the old configuration — such as human capital, productive processes, role of information and communication technologies (ICT) [Bramante *et al.* (2010); Gerstner (2002); Lichtenthal and Copulsky (1993)].

Relying on insights from studies on organizational architectures [Fjeldstad *et al.* (2012); Gulati and Puranam (2009); Mendelson (2000)] and aspiration levels [Gavetti *et al.* (2012); Greve (1998); Washburn and Bromiley (2012)], we explore the relationships between the scope of architectural change and performance gaps prompted by the interplay between social and historical aspiration levels. Although organizations are usually risk averse, they are more likely to take risks if they are failing to achieve their goals or aspirations [Greve (1998)]. Their own past performance and the performance of competitors respectively define social and historical aspiration levels. Comparison between current performance and social/historical aspiration levels defines the performance gap that will overcome organizational risk aversion and push the organization to embark on architectural changes [Grinyer and Mckiernan (1990); Kahneman and Tversky (1979); Labianca *et al.* (2009); Vissa *et al.* (2010)].

This study uses an original database, constructed by merging information from two waves of a survey conducted by Unicredit, an Italian Bank Group. The findings suggest that organizations modify their architecture when the level of performance becomes distant from the desired level. Organizations pursue different strategies according to the extent of this performance gap, i.e. the size of the gap influences the scope of change. A small performance gap leads organizations to introduce minor changes to their architecture. We describe this as an *adaptation* strategy. When the performance gap is large, major modifications are implemented, which we would describe as a *reorientation* strategy. We propose a model to reflect the patterns of architectural changes induced by performance gaps.

2. Theoretical Background

The term architecture is used to characterize structures [Fjeldstad *et al.* (2012)]. It can be applied to various domains including products [Sanchez and Mahoney (2003)], industries [Jacobides (2005)] and organizations [Ethiraj and Levinthal (2004); Gulati and Singh (1988)]. Management scholars introduced the concept of architecture to conceptualize organizations as systems of elements whose interplay with the environment defines the organization's evolutionary path [Dosi and Grazzi (2006); Ethiraj and Levinthal (2004); Fixson and Park (2008); Jacobides (2006); Mendelson (2000)]. Our work builds on the definition of organizational architecture proposed by Mendelson [2000] and Gulati and Puranam [2009]. Mendelson [2000] identifies a set of core elements of organizational architecture through an investigation of how information is processed and distributed within the organization. By defining the organization as an information-processing system that assimilates information from the external context and matches it with internal information, Mendelson focuses on information awareness as the key to understanding organizational architecture. Several contributions explore the theoretical and empirical consequences of the interplay between the formal and informal components of organizational architectures [Gulati and Puranam (2009); Jansen *et al.* (2009); Soda and Zaheer (2012)]. Focusing on changes between formal elements — i.e. the normative social system — and informal elements — i.e. the patterns of social interaction that emerge within an organization — Gulati and Puranam [2009] understand the organizational architecture in terms of combinations of choices.

Organizations change their architecture to align with the characteristics of the environment [Drazin and Van de Ven (1985); Duncan (1972); Mckinley (2011); Stoeberl *et al.* (1998); Venkatraman (1989)]. Organization theory provides different perspectives from which to interpret organizational change. Population ecologists emphasize peremptory environmental determinism [see, e.g. Hannan and Freeman (1984)]. They build on Stinchcombe [1965] and claim that organizations often are inert as a result of various attrition forces. These attrition forces include cognitive lock-in, produced by the initial mode of operation or imprinting and by a lack of search for information on relevant contingencies to which it might be worth adapting. Inspired by contingency theory, Zajac *et al.* [2000] and Siggelkow [2001] discuss the effectiveness of organizational change and argue that a straightforward application of contingency theory contemplates the possibility of beneficial inertia. When environmental contingencies change, organizations need to modify accordingly, but when these contingencies are relatively stable, it might be more convenient for organizations to remain stable [McCarthy *et al.* (2010); Sutherland and Smith (2011)]. This suggests that, under some circumstances, organizational stability is beneficial [Tushman and Romanelli (1985)]. Grandori and Prencipe [2008, p. 235] label this "contingently effective invariance", arguing that the reason for stability is not continuation of a state, but absence in the organization's environment of threats that are contingently effective. If the organization perceives threats in the environment, it will likely develop a new configuration that would ensure the permanence of external fit [Siggelkow (2001)]. Therefore, the decision to change the organizational architecture is influenced heavily by the perception of possible threats in the organization's environment.

The literature on managerial cognition argues that managers' bounded rationality and their resulting propensity to rely on simplified representations of the world to process information, are issues that are relevant to an analysis of the organizational propensity to change [Buyl *et al.* (2011); Cyert and March (1963); Garud and Rappa (1994); Kaplan (2011); Levinthal and March (1993); March (1988); Simon (1955); Tripsas and Gavetti (2000); Wiklund and Shepherd (2003)]. Kiesler and Sproull [1982] explain that cognitive representations typically are based on historical experience as opposed to current conditions. Cognitive representations and the attention patterns of organizational members define the organization's aspiration level — i.e. the line between perceived success and failure [Greve (1998); Lopes (1987); Schneider (1992)]. More precisely, an aspiration level can be described as a "reference point that is psychologically neutral" [Kameda and Davis (1990, p. 56)] or as "the smallest outcome that would be deemed satisfactory by the decision maker" [Schneider (1992, p. 1053)].

Greve [1998; 2003] suggests that organizations process environmental feedback by comparing their performance with that of other organizations in the same industry, and by comparing their current with their past performance. Organizations, thus, use two aspiration levels: a social aspiration level, based on comparison with competitors, and a historical aspiration level, based on comparison with its past performance [Cyert and March (1963); Wood (1989)]. Organizations, similar to many individuals, tend to be risk averse since risky choices open them to many unpredictable outcomes and introduce the threat of poor results. Although organizations might appear resistant to change, in some circumstances, such as if they are failing to achieve goals or aspirations, they will pursue radical architectural change [Greve (1998)]. Social comparison theory suggests that aspiration levels are related to the comparison with the performance of similar others [Cyert and March (1963); Festinger (1954); Labianca *et al.* (2009)]. Organizations do not evaluate their abilities by comparing with others who are too divergent from them. Their abilities must be fairly similar for an accurate evaluation and comparison. Consequently, organizations compare their performance with that of other similar organizations. In addition, aspiration theory argues that organizations compare with their performance history [Cyert and March (1963); Greve (2002); Levinthal and March (1993)].

3. Hypotheses Development

As long as the environment poses no threats, a stable organization is beneficial [Tushman and Romanelli (1985)]. However, in the presence of threats in the environments, stability is a liability for the firm [Siggelkow (2001)]: organizations need to maintain alignment with the contingencies in their environment [Kraatz and Zajac (2001)]. The literature on individual and organizational risk taking explains that decisions to undertake high-risk strategies depend on the context of the choice [Greve (1998); Lopes (1987); Thaler and Johnson (1990)]. In any organizational context, managers take fewer risks if performance exceeds their goals; high organizational risk taking is related to low performance relative to aspiration levels [Bowman (1982); Bromiley (1991); Grinyer and Mckiernan (1990); Singh (1986)]. Managers will accept the risks associated with change if they perceive the presence of a performance gap [Chattopadhyay *et al.* (2001)]. We posit that organizations process environmental feedback and define aspiration levels by comparing current levels of performance with: (i) previous performance; and (ii) the performance of organizations operating in the same industry. When the organization perceives a gap between its performance and social or historical aspiration levels, it implements architectural changes. We therefore expect the following.

Hypothesis 1. A performance gap increases the likelihood that the organization will modify its architecture.

We submit that organizations face two options when implementing architectural changes. First, if both social and historical aspiration levels are in line with the organization's actual performance, it will make the decision to implement ongoing changes to its architectural elements. The aim is to adjust these elements such that they evolve with naturally occurring environmental changes [Feldman (2000); Tsoukas and Chia (2002)]. For example, the organization's ICT architecture needs to be periodically updated to keep pace with technological developments. Second, if the organization's social or historical levels are not aligned to performance, the gap must be filled. The size of the performance gap will influence the organization's strategy: adaptation or reorientation.

3.1. *Adaptation strategy*

A partial misalignment with either the social or historical aspiration level creates a small performance gap that makes expected outcomes generally good. This requires minor changes involving only a few organizational elements. The organization might decide to adopt an imitation strategy in order to bridge the gap with other organizations in its comparison group, or with its past results. This strategy reduces the riskiness associated with change and is legitimated by the dominant behavior in the industry. It provides a way to manage uncertainty and gain legitimacy; imitation of organizational structures is driven by the norms of rationality [Meyer and Rowan (1977)] and uncertainty [Di Maggio and Powell (1983)]. Unusual and innovative practices are rarely adopted [Massini *et al.* (2005)]. The scope of this type of architectural change is to solve a locally defined problem, e.g. to decrease the cost of production through the use of offshoring. The organization's actions are aimed at modifying a single element and, therefore, respond to a problem that involves a small number of actors as opposed to the whole organization. The search for a local solution is preferred due to its lower risks. An example of this is Daehan Steel, a

Korean organization that undertook a business transformation project to enable its future growth as “a total steel solution provider”. The transformation project was aimed at filling a performance gap with its competitors. Daehan Steel implemented a complete modification of its ICT architecture (contract management system, standard cost management, supply chain management, operation system, enterprise resources planning system, pricing strategy planning and diagnosis of ICT operations), which facilitated its growth in the global marketplace [IBM (2010)]. Thus, our second hypothesis is as follows.

Hypothesis 2. A small performance gap increases the likelihood that the organization will implement an adaptation strategy based on minor architectural changes.

3.2. *Reorientation strategy*

Organizations may deal with a misalignment of their performance with both social and historical aspiration levels, i.e. a large gap, resulting in reduced competitiveness with peers, and poor outcomes compared to their past performance. To overcome this, organizations pursue major, thus more risky, changes to their architecture [March and Shapira (1987)]. This is consistent with the work of Yasai-Ardekani [1989] which argues that organizations respond to perceived environmental pressures by making structural architectural changes. The magnitude of these changes is large, since they involve all the elements of the organizational architecture. The large size of the gap suggests a mismatch between external conditions and the organizational architecture and modifications to only one or two elements is likely not to be sufficient. The organization needs to react to the challenges posed by the competitive context: the scope of change in this case will be radically different from the changes involved in an adaptation strategy.

Marks and Spencer’s restructuring is an example of a reorientation strategy. In 1998, the retailer’s revenues and profits were on a downward spiral [Beaver (1999)]. The gap with its historical performance and its competitors forced the new CEO to implement radical architectural change whose scope included: decentralization of operations, restructuring of the internal organization, changes at top management level, revisions to human resources policies and implementation of new technologies [Davies (1999); Grundy (2005); Jackson and Sparks (2005); Merriden (2000); Rippin (2005)]. The changes affected every elements of the organizational architecture. Our third hypothesis is as follows.

Hypothesis 3. A large performance gap increases the likelihood that the organization will implement a reorientation strategy involving major architectural changes.

The three hypotheses are depicted in Figs. 1 and 2. Figure 1 summarizes the types of organizational change and their scale and scope. Figure 2 shows the relation between: (i) the dimensions of the architectural changes; and (ii) environmental feedback.

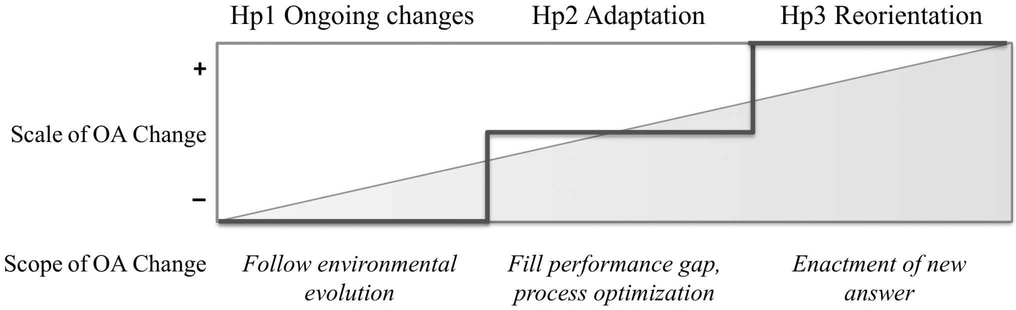

Fig. 1. Conceptualization of architectural changes.

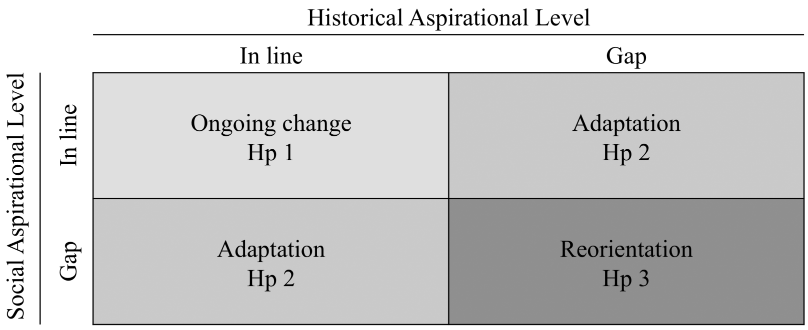

Fig. 2. Architectural changes and environmental feedback.

4. Methods

4.1. *The data*

To address the research questions, we merged two waves of a large survey conducted by Unicredit, an Italian Bank Group. The data referred to two three-year periods: 2001–2003 and 2004–2006. In each wave, Unicredit selected a statistically significant sample of organizations and realized a mixed type sample selection based on a sample survey for organizations with 11–500 employees and a census survey of organizations with more than 500 employees. The samples are representative of Italian manufacturing organizations and they have 80 layers made by five-size classes, four macro-areas and four sectors. The response rates were 28.5% in the first wave and 25% in the second wave. After deleting observations with missing values for one or more variables, we obtained a final sample of 762 organizations.

4.2. *The research strategy*

The empirical strategy consisted of two steps. First, in order to measure the multidimensionality of the organizational architecture, we use principal component analysis (PCA). PCA identifies a proxy for the elements defining organizational architecture. Second, to understand the effect of a performance gap on different degrees of architectural change, we conduct logit and nested logit regression analyses.

4.3. *Dependent variables*

To identify the key elements of organizational architecture, following Gulati and Puranam [2009] and Mendelson [2000], we select formal architectural elements that facilitate transferring and processing of knowledge and information within the organization. We focus on formal organization elements since it is possible to change those elements relatively rapidly [Lamont *et al.* (1994)]. We identified: (i) ICT; (ii) international; (iii) hierarchical; and (iv) human capital.

The ICT element of organizational architecture refers to the presence of tools that facilitate information and knowledge flows within the organization. ICT enables knowledge sharing that reduce temporal and spatial barriers, and the creation of information storage for data for use by virtual knowledge teams [Kristof *et al.* (1995)]. ICT improves communication, facilitates interactions among employees and reduces isolation. It enhances the organization's efficiency by reducing the costs related to timing of interaction and increasing the effectiveness of communications [Love *et al.* (2006); Santa *et al.* (2009)].

The international element reflects the organization's involvement in international markets. When organizations internationalize, they need to assume new knowledge, including experiential knowledge of specific foreign business practices, institutional norms and general experiential learning of how to organize for foreign competition. Exposure to international markets involves the processing of unique and activity-specific knowledge [Cantwell (1989); Eriksson *et al.* (1997); Ghoshal (1987)].

The hierarchical element in the organizational architecture refers to the distribution of decision power within the organization. Simon [1969] claims that hierarchy is a mechanism for coordinating a complex system comprised of multiple specialized units. Since organizations are viewed as institutions for integrating knowledge, hierarchical coordination involves decisions about the mechanisms through which knowledge is diffused within the organization [Grant (1996); Jensen and Meckling (1976); Joseph and Ocasio (2012); Karim and Williams (2012)].

The human capital element of organizational architecture captures the presence of qualified workers and their involvement in knowledge intensive and research and development (R&D) activities. The organization's investment in such activities potentially augments existing stocks of internal knowledge [Cohen and Levinthal (1990); Yeh and Fang (2011)].

The multidimensional nature of organizational architecture calls for PCA. We used 18 items (nine from each wave) of the Unicredit questionnaire. The chosen items are: *ICT*, *ICT intensity*, *ICT tools*, *Export intensity*, *Countries export*, *Concentration of power*, *Group control*, *Percentage of employees involved in R&D activities* and *Percentage of employees with a degree*.

The first set of variables captures the ICT element: *ICT* is a dummy variable indicating whether the organization invests in ICT; *ICT intensity* measures the percentage investment in ICT over total investment in machinery and other equipment and *ICT tools* measures the variety of the ICT tools used through the Herfindahl–Hirschman index of investment in hardware, software and telecommunications infrastructure.

We measure the international element through the following variables: *Export intensity*, the ratio between export sales and overall sales, and *Countries export*, the number of countries to which the organization exports its products/services. These two variables capture different dimensions of the international element and include quantitative (sales) and qualitative (number of countries) aspects.

The third set of variables measures the hierarchical element and it comprises: *Concentration of power*, the Herfindahl–Hirschman index of the stock owned by the three most important shareholders, and *Group control*, a discrete variable that takes the value zero if the organization is not part of a corporate group and the values 1, 2 or 3 according to the organization's position within the group, respectively leading, partially owned or fully owned. This item measures the organization management's autonomy to make strategic decisions.

The last set of variables represents the human capital element: *Percentage of employees involved in R&D activities* is the share of employees working in or connected to the R&D function, in total number of employees; *Percentage of employees with a degree* is the share of employees with a university degree in total number of employees, which is used to estimate the percentage of high-skilled people working in the organization.

We perform separate PCA for each wave, on the selected items, with a varimax orthogonal rotation using the GPF algorithm (see Tables 1 and 2). We use the vgpf option in Stata; this option supports retention of the four components identified.

The PCA allows us to measure the principal components of the organizational architecture. Elements are formed through the aggregation of items tapping into each construct, weighted by their respective component scores. We conducted several tests to assess the psychometric properties of the measures. With the exception of one item which showed a lower value, factor loadings exceeded the recommended cutoff value of 0.60. The analysis allows us to measure the four elements defining organizational architecture: ICT element (*ICT*, *ICT intensity*, *ICT tools*); international element (*Export intensity*, *Countries export*); hierarchical element (*Concentration of power*, *Group control*); human capital element (*Percentage of employees involved in R&D activities*, *Percentage of employees with a degree*).

To measure the architectural change, we examine the changes in each element between 2001–2003 and 2004–2006 and create two dependent variables: *Change dummy* and *Architectural change. Change dummy* takes the value 1 if the organization made at least one significant change in one of the elements of its architecture and 0 otherwise. *Architectural change* takes the value 0 if the organization made no significant changes to any of the elements of its architecture and 1 if the organization made significant changes to one or two elements (adaptation) and takes the value 2 if the organization implements changes to three or four elements (reorientation). Change is significant if the absolute value of the difference between the value of the element in 2001–2003 and its value in 2004–2006 is more than one standard deviation distance from the mean.

Table 1. Matrix of factor loadings.

	ICT element	International element	Hierarchical element	Human capital element
	Component 1	Component 2	Component 3	Component 4
Principal component analysis 2001–2003				
ICT '03	**0.6700**	0.0049	0.0131	−0.0533
ICT intensity '03	**0.3429**	0.0109	−0.0295	0.1980
ICT tools '03	**0.6575**	−0.0091	−0.0041	−0.0089
Export intensity '03	−0.0112	**0.7188**	0.0210	−0.0735
Countries export '03	0.0109	**0.6824**	−0.0089	0.0813
Concentration of power '03	0.0039	0.0642	**0.6834**	−0.0355
Group control '03	0.0010	−0.0440	**0.6995**	0.0437
Percentage of employees involved in R&D activities '03	−0.0241	0.0763	−0.1453	**0.6764**
Percentage of employees with degree '03	−0.0168	−0.0746	0.1446	**0.6965**
	International element	Human capital element	Hierarchical element	ICT element
	Component 1	Component 2	Component 3	Component 4
Principal component analysis 2004–2006				
Export intensity '06	**0.6775**	0.0395	0.0331	−0.0366
Countries export '06	**0.6898**	−0.0268	−0.0445	0.0125
Percentage of employees involved in R&D activities '06	0.0228	**0.7054**	−0.0114	−0.0630
Percentage of employees with degree '06	−0.0146	**0.6975**	0.0154	0.0736
Concentration of power '06	−0.0063	0.0706	**0.7112**	−0.0380
Group control '06	−0.0055	−0.0735	**0.6905**	0.0438
ICT '06	0.0494	−0.0143	0.0805	**0.6372**
ICT intensity '06	−0.1610	0.0422	−0.0861	**0.6125**
ICT tools '06	0.1897	−0.0351	−0.0040	**0.4524**

Table 2. Results of principal component analysis.

Components	Eigenvalue	Percentage of variance explained	Cumulative percent
Principal component analysis 2001–2003			
1	2.170	0.241	0.241
2	1.6220	0.180	0.421
3	1.302	0.144	0.566
4	1.071	0.119	0.685
Principal component analysis 2004–2006			
1	1.671	0.185	0.185
2	1.475	0.163	0.349
3	1.180	0.131	0.481
4	1.047	0.116	0.597

4.4. *Independent variables*

Our independent variables measure the performance gap. An organization compares its performance with average industry-level performance. The difference between the organization's performance measured as the organization's total sale in 2003 and the average performance of organizations in the same sector, defines the social aspiration level. The organization compares its current with its previous performance; the difference between total sales in 2001 and total sales in 2003 defines the historical aspiration level. We use social and historical aspiration levels to build our independent variables. The difference between current performance and aspiration levels represents the organization's performance gap. We consider that the gap is the negative difference between actual performance and aspiration levels. It is implausible that an organization with performance far above that of the competition, such as Microsoft, would aspire to the achievement of lower levels of performance to match industry predictions [Washburn and Bromiley (2012)]. In the first model, we include *Performance gap* as an independent variable; it takes the value 1 if either of two cases is observed: (i) a negative gap between current performance and either its social or historical aspiration level; (ii) a negative gap between current organization performance and both its social and historical aspiration levels. In the second and in the third models, we include *Small gap* and *Large gap* as independent variables. *Small gap* takes the value 1 if there is a negative gap between the organization's current performance and either historical aspiration level or social aspiration level, and 0 otherwise. *Large gap* takes the value 1 if there is a negative gap with both historical aspiration and social aspiration levels, and 0 otherwise. The construction of our measures is in line with Washburn and Bromiley [2012].

4.5. *Control variables*

We include a set of control variables to account for variables that might affect the relation between performance gap and architectural changes. We control for *Size*, measured as total sales in 2003, and for *Age*, calculated as the number of years since the firm's foundation. Also, we include *Innovation* and *R&D intensity*. *Innovation* is a dummy variable that takes the value 1 if the organization introduced at least one product, process or organizational innovation during the three years 2001–2003. *R&D intensity* is the ratio of R&D expenditure to total sales in 2003. To control for sector specificities, in the models we include *R&D intensity by industry* and a series of dummy variables for Pavitt sectors [Pavitt (1984)], i.e. supplier dominated, scale intensive, specialized supplier, science-based. Finally, we control for organization context through four dummy variables for location of the organization in Italy — *North-East*; *North-West*; *Center* and *South*.

We perform Harman's one-factor test on the organization-level variables included in the models to examine whether common method bias might be augmenting the relations detected. We found multiple factors; since the first factor did not account for the majority of the variance (it accounted for only 0.12%), potential problems associated with common method bias were not indicated [Podsakoff and Organ (1986)].

5. Results

Table 3 reports descriptive statistics for the variables included in the models. None of the correlations are so high as to suggest problems related to multicollinearity.

Table 3. Descriptive statistics and correlation matrix.

Variable	Mean	Std. dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Change dummy	0.61	0.49																	
2 Architectural change	0.33	0.47	0.00																
3 Performance gap	0.65	0.48	0.07	0.00															
4 Adaptation∗ Small gap	0.15	0.36	0.03	0.24	0.33														
5 Reorientation∗ Small gap	0.15	0.36	0.03	−0.27	0.33	−0.19													
6 Adaptation∗ Large gap	0.06	0.25	0.00	0.09	0.18	−0.10	−0.10												
7 Reorientation∗ Large gap	0.06	0.25	0.00	−0.13	0.18	−0.10	−0.10	−0.06											
8 Size (million)	45.60	123.00	−0.01	0.00	0.22	−0.03	−0.03	0.21	0.21										
9 Age	31.23	21.13	−0.04	0.00	−0.06	−0.04	−0.04	0.02	0.02	0.01									
10 Innovation	0.73	0.45	0.03	0.00	0.06	0.03	0.03	0.00	0.00	0.06	0.12								
11 R&D intensity	0.01	0.02	0.09	0.00	0.02	0.01	0.01	0.00	0.00	0.03	−0.03	0.19							
12 R&D intensity by industry	0.01	0.01	0.10	0.00	−0.01	−0.01	−0.01	0.00	0.00	0.00	−0.09	0.14	0.39						
13 Scale intensive	0.17	0.38	0.05	0.00	0.07	0.02	0.02	0.02	0.02	0.05	−0.03	−0.01	−0.07	−0.14					
14 Specialized suppliers	0.31	0.46	0.04	0.00	0.00	0.01	0.01	−0.01	−0.01	−0.03	−0.04	0.15	0.14	0.38	−0.29				
15 Science-based	0.04	0.18	0.09	0.00	−0.02	0.00	0.00	−0.01	−0.01	0.04	0.03	0.04	0.21	0.48	−0.09	−0.12			
16 North–East	0.32	0.47	0.01	0.00	0.09	0.02	0.02	0.03	0.03	0.07	−0.08	0.02	0.01	0.08	−0.07	0.12	0.02		
17 Center	0.19	0.39	−0.09	0.00	−0.02	0.00	0.00	−0.02	−0.02	−0.05	−0.05	−0.06	−0.03	−0.07	0.03	−0.12	−0.05	−0.33	
18 South	0.12	0.33	0.03	0.00	−0.02	−0.02	−0.02	0.02	0.02	0.03	−0.11	−0.04	−0.06	−0.08	0.09	−0.18	0.00	−0.25	−0.17

We apply a logit model to investigate Hypothesis 1. The first column in Table 4 shows the results. We support Hypothesis 1 to the extent to which the existence of a *Performance gap* is positive and significant in explaining architectural changes.

To investigate Hypotheses 2 and 3, we use a nested logit estimation technique splitting the econometric estimation into two steps since our dependent variable, *Architectural change*, can be considered a two-stage decision. The nested logit model, first proposed by Ben-Akiva [1973], represents an extension of the multinomial logit model. However, the multinomial logit suffers from independence of irrelevant alternatives (IIA), a disadvantage caused by a property of the multinomial logit that assumes that the relative probability of choosing between two alternatives is not affected by the presence of additional alternatives. In our case, the alternatives are not independent since, as suggested by Hannan *et al.* [2003], changes in one architectural element are likely to result in a cascade of changes to other architectural elements.

Since the IIA assumption is violated, we use a nested logit model to group alternatives into subgroups (nests) such that the IIA is valid within each subgroup [Train (2003); Winkelmann and Boes (2006)]. Figure 3 depicts the setup of the specified model. It shows the asymmetric nature of the data in the sense that the second level outcome is available only if the respondent provides a positive response in the first level. Among the 762 observations considered, 302 (40%) made no significant architectural changes, 423 (56%) adapted their organizational architecture and the remaining 30 (4%) reoriented their organizational architecture. We follow Drucker and Puri [2005] and use interaction effects to implement this asymmetric specification. The nested logit modeling technique also requires some reshaping of the data to observe each organization once for each of the three possible outcomes in the tree depicted in Fig. 3. Thus, we are analyzing 2286 observations. Table 4 presents the results of the nested logit regressions examining the presence of architectural changes as opposed to the absence of changes to the architecture. The base category is the organization that has not changed its architecture. Table 4, Column 1 reports the results of the logit estimation (Model I); Column 2 (Model II) presents the results of the model considering *Small gap* as the independent variable;

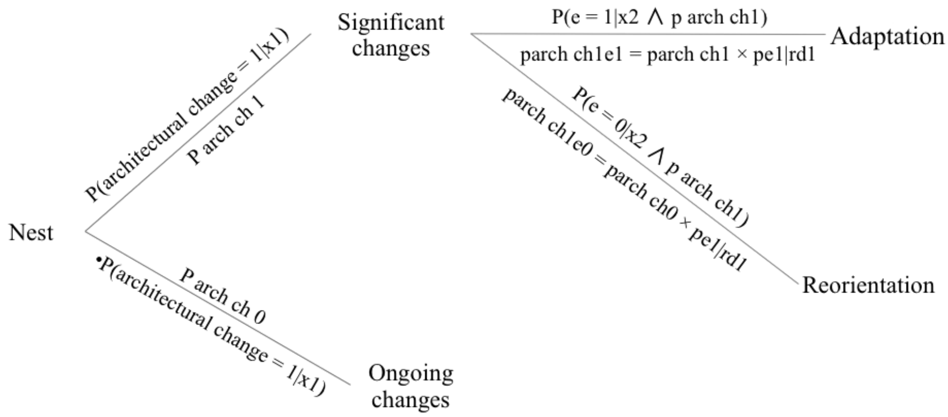

Fig. 3. Nesting structure of the implemented strategy.

Table 4. Econometric models.

	Model I *Logit model* DV: Change dummy		Model II *Nested logit model* DV: Architectural change		Model III *Nested logit model* DV: Architectural change	
	Coeff.	S.e.	Coeff.	S.e.	Coeff.	S.e.
Stage 2	Variables affecting the choice of "adaptation" or "reorientation"					
Adaptation ∗ Small gap			0.292**	(0.155)		
Reorientation ∗ Small gap			0.285	(0.369)		
Adaptation ∗ Large gap					−0.076	(0.238)
Reorientation ∗ Large gap					0.787**	(0.409)
Stage 1	Variables affecting the choice of "ongoing change" or "significant change"					
Performance gap	0.320**	(0.160)				
Size	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
Age	−0.002	(0.004)	−0.002	(0.003)	−0.003	(0.003)
Innovation	0.007	(0.172)	−0.001	(0.173)	0.021	(0.172)
R&D intensity	8.186†	(5.223)	8.038†	(5.220)	8.037†	(5.238)
R&D intensity by industry	10.951	(11.532)	13.795	(11.542)	13.800	(11.592)
Scale intensive	0.464**	(0.216)	0.469**	(0.216)	0.486**	(0.216)
Specialized suppliers	0.171	(0.200)	0.152	(0.200)	0.148	(0.199)
Science-based	0.850	(0.621)	0.762	(0.622)	0.790	(0.625)
Supplier dominated	Benchmark		Benchmark		Benchmark	
North–East	−0.063	(0.185)	−0.057	(0.184)	−0.037	(0.184)
Center	−0.428**	(0.216)	−0.430**	(0.216)	−0.419**	(0.216)
South	0.172	(0.266)	0.180	(0.266)	0.173	(0.266)
North–West	Benchmark		Benchmark		Benchmark	
Stage 1						
Constant	0.104	(0.250)	0.060	(0.242)	0.203	0.230
Stage 2						
Constant			—	—	—	—
N	762		2.286		2.286	
LL	−498.3		−609.01		−608.76	
Chi2	28.95**		25.15**		28.20	

Note: One-tailed tests: $^{\dagger}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. Standard errors (S.e.) in parentheses.

Column 3 (Model III) reports the regression results for *Large gap* as independent variable.

Our results support Hypothesis 2: we find that *Small gap* is positive and significant in explaining the adaptation strategy, but not significant for reorientation. We find empirical support also for Hypothesis 3: *Large gap* is positive and significant in explaining major architectural changes leading the organization to implement a reorientation strategy.

6. Discussion and Conclusion

This study investigated how organizations react to feedback from the environment. Our results suggest that organizations modify their architecture when their levels of performance fall below desired levels. We show that organizations pursue different strategies in order to align their architectures to the conditions of the environment. We used an alternative discrete model for dimension of performance gap influencing decision related to adaptation or reorientation. To compute performance gap we used historical and social aspiration levels. When performance is misaligned to one dimension of one of the aspiration levels, minor changes will be made to the organization's architecture — i.e. it will pursue an *adaptation* strategy. When the misalignment is with both the historical and social aspiration levels, the organization will implement major changes to *reorient* its architecture.

This study has three implications for academic research. First, it contributes to the emerging scholarly debate on the characteristics of organizational architecture and the decision processes underlying changes to it [Buyl *et al.* (2011); Fjeldstad *et al.* (2012); Gulati and Puranam (2009); Gulati *et al.* (2012); Soda and Zaheer (2012)]. We explored the dynamics of architectural change by measuring modifications to its constitutive elements, which adds to our understanding of the decomposition property of organizational architecture [Augier and Sarasvathy (2004); Simon (1969)]. Our results suggest that the size of the performance gap influences the number of elements that are changed. The decomposition property underpins our understanding of the evolution of organizational architecture by enabling a balance between the need for change — highlighted by the observed performance gap — and the risks associated with it.

Second, this paper contributes to the literature on organizational change [McCarthy *et al.* (2010); Nickerson and Zenger (2002); Tsoukas and Chia (2002); Tushman and Romanelli (1985)]. We show that organizational change can be represented as a nested model: organizations can undertake ongoing change, adaptation, or reorientation. This adds to Nickerson and Zenger's [2002] findings that proved through simulation models that organizations realign their structure to the environment based on an alternative discrete model. Using empirical data, we demonstrate that the size of the performance gap is the watershed where the advantages of organizational stability are lower than the losses in competitive advantages.

Third, this study bridges between two important research streams: aspiration level [see, e.g. Gavetti *et al.* (2012); Greve (1998)] and architectural change. Sustained poor performance, amongst other things, triggers architectural change. Echoing contingency theory [see, e.g. Siggelkow (2001)] this study throws light on this phenomenon: gaps in performance highlight failures to achieve aspiration levels, which then leads to architectural change. This enriches our understanding of the organizational dilemma of choosing stability versus change [Tushman and Romanelli (1985)]: successful organizations prefer ongoing changes in order to reduce or avoid risks, but organizations that experience performance losses are likely to implement important turnaround.

6.1. *Future research agenda and limitations*

The study points to some interesting avenues for future research. In the context of the theory on aspiration level [Buyl *et al.* (2011); Gavetti *et al.* (2012)], organizations define the social aspiration level by comparing themselves with other organizations. In line with previous studies [see, i.e. Washburn and Bromiley (2012)], we identified the comparison group as organizations in the same industry. However, how organizations select their comparison group varies and each organization uses a subjective process [Massini *et al.* (2005)]. An intriguing extension to this study would be to explore organization-specific comparison groups. Accurate identification of the appropriate comparison group would appear relevant for managers; since social aspiration level impacts on the scope of architectural changes, incorrect specification might lead to inappropriate reactions.

This study focuses also on the short-term effects of a performance gap on architectural changes. Future research could investigate how architectural changes affect future performance. The long-term effect of the appropriateness of reorientation and adaptation strategies triggered by the existence of large or small gap could be investigated.

This study has some limitations related to the interplay between organizations and their environment. The environment can change organizations but, at the same time, organizations can change the environment to an extent [Mckinley (2011)]. In this study, we could only observe how feedback from the environment affects organizations and not how organizations can modify their environment. Finally, we should acknowledge that the organization's strategy might depend on the characteristics of the geographical and social location. In this research, we used a sample of Italian manufacturing organizations; the result might depend on the specificities of the Italian context.

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