

# **From Ivory Towers to Learning Organizations: the Role of System Dynamics in the “Managerialization” of Academic Institutions**

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## **ABSTRACT**

Higher Education organisations face today strong pressure to adopt renewed structures and management systems. Efficiency, efficacy and market principles have become common words within the University and management practices and principles are migrating to the academic context, boosting a process of “managerialization”.

However, preliminary results show that the new policies adopted by university managements have led to counter-intuitive and undesired results, thus adding further ambiguity to the understanding of the dynamics existing within the HE sector.

This paper explores the role that System Dynamics could play in the “managerialization” of universities. System Dynamics tools could allow academic decision makers to better keep under control the complex and dynamic university environment: in these terms, the paper suggests the use of modeling and simulation techniques in order to capture the complex and dynamic structure of the university system and to explore the consequences of the policies and decisions that academic managements are currently taking.

**KEYWORDS:** University management; System Dynamics; Managerialization; Complexity; Quality; Organisational learning; Common understanding.

## **1. INTRODUCTION**

Higher Education (HE) organisations face today strong pressure from institutional environments to adopt renewed structures and management systems. The reasons for the vast reform sweeping across European and non-European countries have to be found in a substantial lack of efficient and effective academic educational and research programmes and in a widespread financial crisis of the public sector. The global scenario is even worse because, as in Italy, the number of students is decreasing due to demographic reasons.

As a consequence, calls for a more effective and efficient management of the resources destined to universities are continuously and increasingly heard. These calls, however, do not come only from external parties to the institution but also from the very inside of it, i.e. from professors and researchers. Efficiency, efficacy, flexibility and, more in general, market principles, have become quite common words within the University; managerial techniques and competition policies are often discussed;

management practices and principles, once adopted only by the private sector, are migrating to the academic context, boosting a so-called process of “managerialization”.

However, the effects of recent moves in this direction are ambiguous: preliminary results of the new policies adopted by university managements led to counter-intuitive and undesired results, thus adding further ambiguity to the understanding of the dynamics existing within the HE sector. This situation seems to be particularly problematic when facing performance-related evaluation processes, such as those related to the assessment of teaching and research quality.

This said, it is author’s opinion that academic managements need to adopt powerful information tools in order to keep under control the complex and dynamic university environment.

Starting from the previous considerations this paper suggests the use of modeling and simulation techniques in order to capture the complex and dynamic structure of the university system and to explore the consequences of the policies and decisions that academic managements are currently taking. In particular, this paper explores the role that the System Dynamics methodology could play in the reforming process of academic institutions. The aim is to highlight the potentialities that the System Dynamics approach offer to academic decision-makers, helping them to better face organisational changes.

In so doing, section Two will summarize the main features of the managerialization process of the University, focusing on the fundamental dynamic and complex problems it is possible to identify within the HE system. Section Two also takes into consideration the main organisational and behavioural consequences that the managerialization process could provoke on academic players.

Section Three will be focused on the System Dynamics methodology, exploring its main scopes and tools. Section Four will present some final remarks.

## **2. THE “MANAGERIALIZATION” OF THE UNIVERSITY**

### ***2.1. Preliminary considerations***

As the oldest institution in European societies the University has continuously evolved during the last centuries, transforming and adapting itself in accordance with the evolutions and the demands of its environment.

In the past three decades universities of European and non-European countries have faced a series of massive organisational reforms. The entire mission and the core values of these institutions have been consequently reshaped and have evolved according to new demands and new requests coming from the whole of their stakeholders. In so doing, the traditional *modus operandi* of universities has changed and the once adopted humboldtian model of university has going disappearing.

In this regard, two main features have traditionally characterized the University:

- a) in European countries universities have generally been state agencies, owned by the State and run by the government;
- b) academic freedom has always been considered as a priority by scholars and has become an individual right over the last centuries.

However, the deep state of crisis in which universities have recently fallen has led to the introduction of a massive process of reorganisation. This “legitimacy crisis”, as Neumann and Guthrie refer to (2002, 722), has consequently led to “the promotion of

«new» management systems, typically characterized by the downsizing, re-engineering and restructuring” of these institutions.

This “revolution” is consequently obliging academic institutions to introduce considerable changes in their decision-making processes, implement renewed information systems and new managerial methodologies and reshape their organisational structures and the strategic relationships with their stakeholders.

This vast process of transition has been defined and labelled with many different terms as: *managerialization, corporatization, marketization, customerization, modernization, commodification, rationalization, privatization, commercialization, professionalization, accountingization*<sup>1</sup>. Generally, if referred to the whole of public administration, this process has been frequently defined as “new Public Management”<sup>2</sup>. As a consequence, there is a general tendency to reorganise and restructure modern universities as *entrepreneurial universities* and there is a clear need for modern managerial techniques. Among these, in particular, evaluation processes, the Total Quality Management (TQM) approach, continuous improvement processes or, even, the Balanced Scorecard<sup>3</sup>.

Frequently led by laws, the reform of the University is consequently leading to a relevant change in the core values of these institutions. From the “ivory towers” they used to be, namely elite institutions characterised by complete and undisputed intellectual and behavioural autonomy, the universities are now becoming sort of customer-oriented and revenue-seeking enterprises in many countries<sup>4</sup>.

Summarizing this situation, many scholars suggest and indicate that the *role* of academic institutions is changing as a response to societal, educational and governmental pressures.

This situation is impacting on many academic players and stakeholders, and should be analysed referring to its main features, as follows.

## **2.2. Governance**

Universities are evolving from the collegial institutions they were in the past.

As previously mentioned, the traditional humboldtian model is being abandoned and universities are becoming *entrepreneurial institutions*. This implies there could happen many relevant changes in the traditional model of governance and that the role of key-players and the procedures governing the decision-making process within academic organisations could sensibly evolve.

The collegial community that in the past was mainly interested in producing a free and widespread product, i.e. knowledge, it is now driven by the necessity to reach high levels of revenues, to collect funds coming both from the public and the private sector and to enroll new students.

This situation is definitely shifting the focus of academics from the aims pursued in the past to new goals to be reached. Deans have become top-managers, teachers are

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<sup>1</sup> See K. Saravanamuthu, T. Tinker (2002, 548); G. Boyce (2002, 588); B. Czarniawska, K. Genell (2002, 456); J. Currie, L. Vidovich (2000, 135); G. Singh (2002, 682-683); L.D. Parker (2002, 605-606); R. Neumann, J. Guthrie (2002, 721).

<sup>2</sup> On these topics see C. Hood (1995); M. Barzelay (1999); L.R. Jones, J. Guthrie, Steane (2001a and 2001b).

<sup>3</sup> On these issues see L.D. Parker (2002, 605); S. Lawrence, U. Sharma (2002, 661); K. Saravanamuthu, T. Tinker (2002, 549); J.F. Dillard (2002, 626).

<sup>4</sup> Many scholars refer to universities as “ivory towers”: among them, H. Etzkowitz, A. Webster, C. Gebhardt, B.R. Cantisano Terra (2000, 313) and B. Czarniawska, K. Genell (2002, 457).

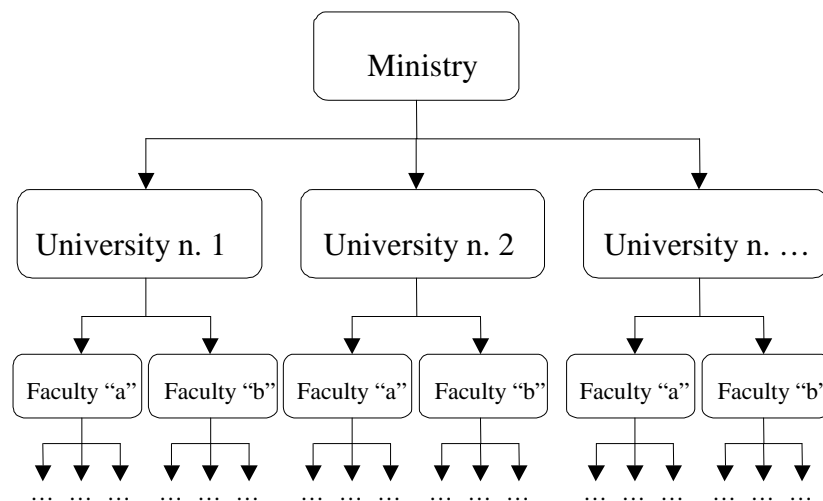
businessmen, internal bureaus and committees are based on managerial teams operating on the market. The interrelationships among these actors consequently evolved, becoming much more complex than in the past decades<sup>5</sup>.

This situation is particularly relevant since, within a university, a single person could be involved by many different decisions and be himself the decision-makers at different levels of the institution. For instance, a single person could be:

- a teacher within a Degree Programme;
- a member of the University Evaluation Committee;
- a member of the Committee of Department Chairmen;
- a member of some Governing University Boards, such as the Academic Board or the University Administration Committee;
- etc.

This said, an academic system most of the times, such as in the Italian case, is characterised by the following structure:

FIGURE 1. - An example of HE system architecture.



The picture shows the hierarchical levels within the University system. It is evident that a single person could be involved in the decisions taken at different and interrelated levels, thus impacting on his own job and interests in many different ways.

It also seems evident that with many decision-making levels, the evaluation and the planning processes have to set different goals and be properly “customized”. In particular, these tasks will have to be carried out separately by the respective evaluation and planning bodies.

As some scholars suggest, this could eventually oblige academics to face high levels of complexity, dealing with issues impacting on their own job-roles at different levels of the structure. They could be consequently unable to discern the real impacts of their

<sup>5</sup> As R. Neumann, J. Guthrie underline (2002, 725), “in many traditional universities, the traditional committee-based model was perceived as being forced out early in the creation of the UNS, replaced instead by a hierarchical management model. This model is characterized by a significant increase in the number of «professional» management appointees in the central and faculty/school bureaucracy. (...) With the increase in «professional» appointments has come a concomitant increase in their decision-making authority (...) [and] collegial modes of governance have been quickly replaced by stronger managerial structures and practices, which contain a concentration of executive power”.

decisions, or could be stimulated to pursue some short-term goals instead of long-term aims. Even more important, they could be not aware of the real feedback structure in which they are embedded.

In this regard, L.D. Parker (2002, 615) recognizes that “university change will be a continuously unfolding, non-linear, dynamic process full of unforeseen contingencies, modified pathways and revised strategies. Significant, long-term changes to organization interpretive schemes practices are almost inevitably complex, messy and at times painful, unsettling and stressful to organization members. Empathy, sensitivity and stamina are required of all parties”.

Even more important, this situation could lead to a dangerous long-term problem for universities, because their short-term goals are nowadays those of acquiring new customers and competing on the market of knowledge production; as G. Boyce argues (2002, 590), “the economic rationalist agenda privatizes and commercializes higher education to such an extent that the total concentration on responding to market trends means the capacity for critical, long-term thinking is lost”.

It is author’s opinion that simulation techniques could be very helpful within universities, particularly if used at high, top-management levels. System Dynamics, for instance, could usefully help key players to better understand their position in the system of knowledge production, making clearer the consequences of the actions carried out and the possible impacts of the decision taken on the different academic bodies and sub-units.

In this regard, Kennedy (2000a and 2000b) refers to many System Dynamics applications and publications on the University management issue, proposing an initial taxonomy of System Dynamics models in Higher Education. The author classifies the contributions taken into consideration, into six different areas of concern over five hierarchical levels, as follows:

TABLE 1. - Areas of concern and hierarchical levels in the University system

<i>Specific Area of Concern</i>	<i>Hierarchical Level</i>
a. Corporate Governance	1. National
b. Planning, Resourcing and Budgeting	2. Regional
c. Teaching Quality	3. University
d. Teaching Practice	4. Faculty
e. Microworlds	5. School
f. Enrolment Demand	

### ***2.3. The steering method***

The process of university managerialization could be realised following different paths. Trow (1994), for example, has introduced the terms *soft* and *hard* in order to describe two possible forms of managerialism and their related impacts on the academic profession<sup>6</sup>:

- *soft managerialism* seeks to provide higher education at the lowest cost and focuses on improving the efficiency through which an institution fulfils its stated mission. This approach mainly operates at an institutional level, where academic managers try to adapt to their universities policies which have been defined at a national level.

<sup>6</sup> On these topics see P.L. Galbraith (1998a; 1998b; 1998c).

As a consequence this approach should not imply significant organisational and operational changes in universities;

- *hard managerialism* involves the re-shaping of higher education through the introduction of new management approaches at national level that become continuing forces in directing the future. This second approach establishes performance indicators, criteria and rules by which outcomes of educational activities are assessed and access to public funding is determined by consequent “reward” and “punishment”.

It is still unclear which path will be followed in many countries. In some experiences the hard approach seems to have been preferred to the soft approach. In any case, care should be taken in choosing the proper form of managerialization, and in understanding its related strengths and weaknesses. Lastly, full consideration should be given to alternative options.

This said, within the HE sector the reform process could be sustained imposing a regulatory approach or could follow a different way, adopting a so-called meta-regulatory approach. Basically, the regulatory approach is a much more prescriptive approach in nature. Scott (2003, 9) deals with both approaches by analysing the HE systems in the U.K. and Australia. These countries have led the field in enacting changes which other states have subsequently emulated.

- a) In Scott’s view, any kind of state or institutional *regulatory* system that sets rigid prescriptions for universities, produces the side-effect of not guiding the subjects’ behaviour towards the desired direction. It could also provoke a sense of reticence and bring out misgivings about the new evaluation process. Scott also underlines that a regulatory approach all too often places the emphasis on quantitative scientific production over a qualitative one and rigid direct control over autonomy.
- b) By contrast, a *meta-regulatory* strategy, used by state institutions or institutional bodies, provides forms of indirect control instead of direct control. By giving the participants within the system a certain degree of autonomy, indirect forms of control could stimulate managerial skills and organisation, and guide participants towards the achievement of regulatory objectives set for each department or sector. The implementation of a meta-regulatory approach could be also less costly than direct forms of control and more effective in guiding public sector behaviour towards the achievement of pre-set goals.<sup>7</sup> This solution is particularly effective in university institutions that are traditionally viewed as loosely-coupled institutions and are strongly characterised by their autonomy and capacity for self-organisation<sup>8</sup>. It also provides the basis and stimuli to guide the participants of the evaluation towards their objectives even if those objectives are set by institutions outside the university.

#### **2.4. The academic stakeholders**

The number of academic stakeholders can be considered much more increased if compared to the past. Briefly, the following groups can be considered as academic stakeholders<sup>9</sup>:

- a) the students and their families;

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<sup>7</sup> See C. Scott (2003, 9).

<sup>8</sup> See T. Reponen (1999).

<sup>9</sup> On these topics, see G. Singh (2002, 689); M. Kennedy, C. Clare (1999).

- b) private and public firms and institutions;
- c) the State and all the national and local governments;
- d) the community.

Recent reforms, the lack of financial resources and the request of increased levels of efficiency, efficacy and flexibility have deeply changed the once in use relationships between the University and the above-mentioned groups.

- a) *The students and their families*: the relationship between the teacher and the student has considerably evolved towards a relationship between a business-man and a client/customer. The position of the students in the knowledge production sector is indeed a particular one: they can be both considered as an academic stakeholder *and* as the final product of this process. As a consequence, they must be willing to invest in education for themselves and must be aware of the best “products” (i.e. academic courses) offered on the related market<sup>10</sup>. The ultimate consequence of this situation is that teachers could look at students in a different way, so boosting a massive process of “commodification” of higher education policies, products and processes.
- b) *Private and public firms and institutions*: universities and private firms are nowadays called to an increased cooperation, towards an overall integration of means and scopes. In so doing universities should promote a larger number of research programmes and be finalized to the creation of applicable knowledge: for instance, the ever-increasing number of University “spin-off” companies testifies this situation.
- c) *The State and all the national and local governments*: reforms across European and non-European countries have been primarily promoted through the direct intervention of national and local Governments. In so doing, they can be seen both as immediate stakeholders of universities *and* as the main actors of the reform. Indeed, once the welfare state has proved to be largely ineffective in several European countries, national governments moved towards the adoption of market principles, aimed at introducing increased levels of competition among universities and, more in general, the whole of public administration. Accountability measures, performance-related evaluation and benchmarking systems have been discussed, tested and introduced in the academic sector. The role of local and national governments is even more stressed when considering some relevant issues related to the current situation of the HE sector in many countries. Consequently a clear picture of the reform involving European universities should be obtained also considering the following issues (V. Lynn Meek 2000, 25-26):
  - higher education has become a mass phenomenon with substantial costs that need to be reduced: the financial burden of this mass education should be shifted or it should be possible to realise more value per Euro committed in this sector;
  - there is a clear will in order to tie in a more closely way the higher education sector and the national economy;
  - becoming a mass phenomenon, higher education is becoming more a political issue;
  - in countries, such as Italy, due to an aging population the social service burden on the national treasury is continuously and dramatically rising, obliging

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<sup>10</sup> As V.Lynn Meek (2000, 24 and 29) stresses, “the shift towards the «market» as a form of higher education steering is underpinned by an ideological shift towards higher education as a private rather than a public good. (...) Knowledge produced within such a context becomes a commodity. It can be bought and sold. It is intellectual property, private intellectual property”.

- national governments to cut expenditure and to demand higher levels of efficiency from public sector institutions;
- in most of the industrialised countries, traditional manufacturing industries are being replaced by the so-called “knowledge processing sector”, of which higher education is an integral component.
- d) *The community*: the wider community is a relevant academic stakeholder and each academic institution has some obligations in the areas of<sup>11</sup>:
- access to the facilities of the institution for the local community;
  - contribution to the wider academic community;
  - providing services to the international community via the enrolment of overseas students, collaborative research, consultancy and other projects;
  - the welfare of society in general.

### **2.5. The “culture of quality”**

One of the main goals of the reforms across Europe is to promote a more efficient academic system, characterised by high standards of teaching and research quality.

The “quality” of a product or of a service can be considered in broad terms as the capacity of that object to efficiently and effectively satisfy some predefined requirements. It also refers to the capacity to assure a high level of customer satisfaction at competitive costs and/or market conditions. Furthermore, the concept of *quality assurance* has a great importance for several reasons:

- firstly, it recalls the academics’ responsibility to define appropriate standards and ensure that those standards are being met;
- secondly, it implies that universities and professors have to offer good quality education to their students;
- thirdly, it makes academics and higher education institutions accountable. Consequently, they have to safeguard the public interest in regards to standards of higher education qualifications and to encourage continuous improvement in the management of higher education quality.

These goals and tasks are achieved by setting and reviewing standards and quality, and providing reference points that could help to define clearer and more explicit overall standards.

In the academic world, the so-called “culture of quality” is continuously spreading, often resulting in the adoption of managerial techniques and approaches once used traditionally only by private sector firms. Among these techniques we could mention methodologies such as the Total Quality Management (TQM), “continuous improvement” processes or the Balanced Scorecard.

It is fundamental to stress that most of these methodologies adopt a systemic approach to management and have the ultimate aim to promote long-term efficiency and strategic thinking.

One methodology, in particular, seems to be worth of consideration within the HE system: *Total Quality Management*<sup>12</sup>. This approach is based on the idea that each activity that receives inputs from an external environment and transforms those inputs

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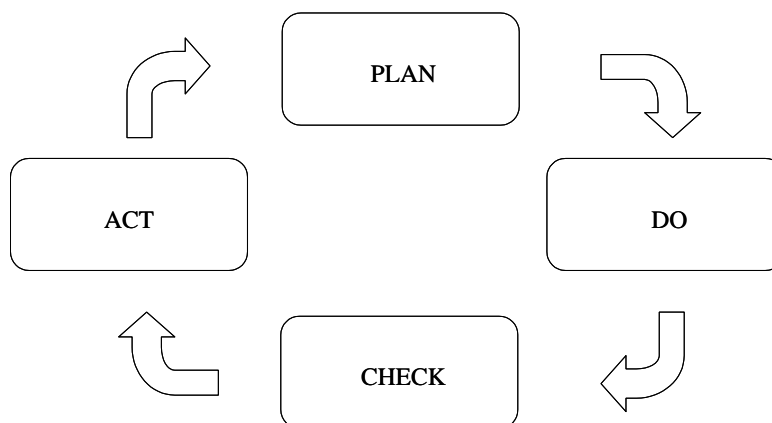
<sup>11</sup> M. Kennedy, C. Clare (1999, 3)

<sup>12</sup> See G. Singh (2002); N. Aly, J. Akpovi (2001); G. Holmes, G. McElwee (1995).



into outputs for an external market, can be considered and studied as a process<sup>13</sup>. The “process approach” is specifically adopted and promoted by the ISO 9000 family. The ISO 9000 family of international quality management standards and guidelines has earned a global reputation as the basis for establishing quality management systems<sup>14</sup>. Moreover, the TQM approach adopts the PDCA (Plan - Do - Check - Act) model, i.e. a system-oriented and problem solving method. This method could be represented as follows:

FIGURE 2. - The PCDA approach to management.



The four steps of the method constitute a systemic approach to decision-making and management and consequently require a long-term focus and a strategic thinking.

In particular, the four stages require managers to:

- a) Plan: define and analyse a problem and identify the root causes;
- b) Do: devise a solution, develop a detailed action plan, implement it systematically;
- c) Check: confirm the outcomes against the plan, identify side effects and issues;
- d) Act: standardise the solution, review and reflect and begin to identify the next issue.

The cycle should then systematically repeat itself, being a feedback loop.

## 2.6. Evaluation and formula funding

Assessment of teaching and research performance has become a priority within the HE system.

In many countries this situation has led to the introduction of assessment schemes and many formula funding have been developed and tested. Schemes such as the *Research Assessment Exercise (RAE)* are increasingly suggested as the “one best way” in the academic sector in order to provide and assure higher levels of efficiency, flexibility and quality.

Such schemes, however, could provoke side-effects which could had not been correctly anticipated, producing several organisational and behavioural impacts on the

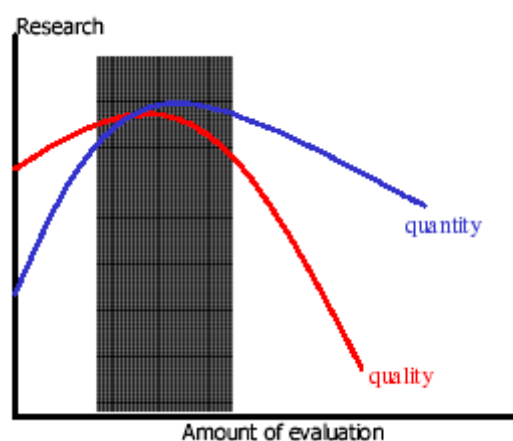
<sup>13</sup> The underlying assumption of this approach is that a desired result can be achieved more efficiently when activities and related resources are managed as a process. Furthermore, each process is linked to some other processes and can be divided into sub-processes.

<sup>14</sup> The new ISO 9000: 2000 is based on 8 fundamental principles: a) customer focus; b) leadership; c) involvement of people; d) process approach; e) system approach to management; f) continual improvement; g) factual approach to decision making; h) mutually beneficial supplier relationships. All the principles mentioned above can be applied with some variations to a variety of different fields.

academic players, both at an individual level (the single teacher/researcher) and at a system level (a whole University). Among them, many scholars identify relevant changes in the behavioural and on-the-job attitude of academics. For instance, through the RAE research is basically measured and funded by government in terms of previous research grants won, the number and rate of post-graduate student degree completions and quantum of published output. This situation has led to an increased amount of publications in response to the pressures upon academics and departments to increase the amount of research funding awarded by government. It is not completely clear if an increase in the amount of publications is followed by a high level of quality<sup>15</sup>.

The real risk of this situation is that the evaluation process will eventually lead to a decrease both in quantitative productivity and in quality value of the publications carried out, as shown in the following picture:

FIGURE 3. - Effects of evaluation on quantity and quality of research (Source R. Brook 2000 and G. Rebola 2003, 48).



Many scholars have commented on this situation highlighting its main consequences.

For example, Davies and Thomas (2002, 181) point out that, at least in their country, “as there are no clear rewards from teaching excellence, the instrumental academic is encouraged to concentrate on the more visible and quantifiable aspects of academic performance. (...) As there is no direct funding attached to teaching quality, it is unlikely to have the same status as research. (...) [Furthermore] discussion about research, it is suggested, is invariably restricted to just two questions: how much money will it bring in, and how many publications will it generate?”

If we consider the Australian case, Butler (2003, 154) explains that “increased system-wide and institutional performance evaluation based on aggregate output measures appears to be altering researchers’ publication habits” so boosting a sort of “publication inflation”.

Briefly, academics will focus their main efforts on a “production-measurement approach” (Singh 2002, 689), that is to say, on those tasks that are measured and rewarded, while diminishing or ignoring a variety of other unmeasured activities such as journal refereeing, textbook writing, conference organising and other collegial and

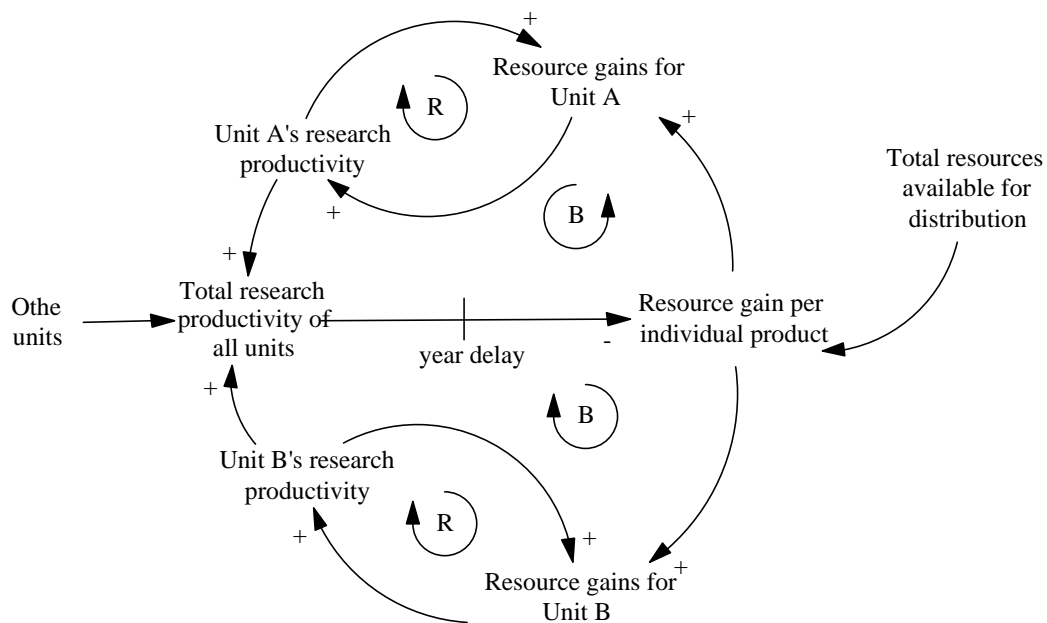
<sup>15</sup> M. Abbott, C. Doucouliagos (2003, 92) take into account this problem stating that “there is the issue of the quality of the output. In the case of the Australian universities focusing on outputs (students enrolled/graduating and research) without considering the quality of education provided might bias the efficiency scores in favor of high output and low quality institutions (if they exist). A lack of quality-adjusted data for output levels necessitates the abstraction from the issue of quality”.

social activities. In this regard, Willmott (1995, 1022) stresses that “as the pressures upon academics mount, it is only to be expected that corners will be cut or, at least, that academics will become less generous and diligent when «servicing» their «customers»”.

Furthermore, some scholars clearly proved the inconsistency of some formula funding schemes. Some of them developed a System Dynamics model in order to take into account all the effects we have just mentioned and to explore both the short-term and the long-term effects of such policies.

Among them, for instance, P.L. Galbraith identified several feedback loops in the Australian University system. Basically, in order to increase productivity, Australian universities instituted various incentive schemes in order to make individual units more active. Such schemes allocate most of the teaching and research budgets on the basis of research productivity.

FIGURE 4. - Causal Loop Diagram on the Australian formula funding problem (Source: P.L. Galbraith 1998, 79).



As shown above, Galbraith developed some CLD's and a simulation model that showed that in the long term the effects of such a scheme were irrelevant: indeed, “whether or not there is an increase in productivity, no increase occurs in the funds available for allocation. (...) Ironically, in the absence of funding growth, every additional publication, every additional grant obtained, and every additional thesis student graduated helps to ensure that less is obtained for that unit of effort than for the previous one” (Galbraith 1998, 80-81).

Summarizing the previous considerations, this section of the paper stressed that universities are characterised for being not only messy institutions, but also very tightly coupled organisations. Within them it is easily possible to identify a plethora of feedback loops that impact on each other: competition in areas such as student enrolment and research productivity, efforts to contain debt by staff attrition, competition between institutions for students, setting goals for enrolment levels, distribution of economic resources on the basis of research activity, are all elements that

provide contexts for the manifestation of delayed feedback loops, escalation, sliding goals and “tragedy” scenarios.

Due to the difficulties in managing complex environments the whole picture in terms of developing interventions is tough to analyse: hence, the impact of various external interventions and strategies adopted by institutions to manage and control factors is tough to evaluate, and to observe the impact on the system as a whole is problematic.

Furthermore, we should consider that limited human cognitive processes prevents an adequate comprehension of the dynamics occurring within a system. Bounded rationality, misperception of feedbacks, simplified or wrong mental models, inability to infer correctly the dynamics of all but the simplest causal maps, limited information, are only some of the major limits the human decision-maker has to face continuously (Sterman 2000, 26-27).

For these reasons System Dynamics tools could provide a useful and powerful aid in dealing with complex issues and systems such as the academic one.

This issue will be better analysed in the following section.

### **3. THE SYSTEM DYNAMICS APPROACH**

System Dynamics models and tools have proved their validity over more than 40 years of application in a variety of different fields.

Based on the concept of feedback and on information-feedback control theory, System Dynamics can be considered as “a perspective and a set of conceptual tools that enable us to understand the structure and dynamics of complex systems. System Dynamics is also a rigorous modeling method that enables us to build formal computer simulations of complex systems and use them to design more effective policies and organizations. Together, these tools allow us to create management flight simulators - microworlds where space and time can be compressed and slowed so we can experience the long-term side effects of decisions, speed learning, develop our understanding of complex systems, and design structures and strategies for greater success”<sup>16</sup>.

To reach its goals and to support the decision-making process, System Dynamics offers a number of different tools, both qualitative, as diagramming tools (causal loop diagrams, stock and flow maps, etc.) and quantitative (formal models based on a rigorous mathematical language) in order to identify, portray and analyse the critical feedbacks determining the dynamics of the analysed systems<sup>17</sup>.

This said, a model could assume several forms as “models can be viewed as maps that capture and activate knowledge. They can be also viewed as frameworks that filter and organize knowledge. Finally they can be viewed as microworlds for experimentation, cooperation and learning”<sup>18</sup>.

However, it is particularly relevant to highlight that the role of a System Dynamics model and even, more important, of the whole modeling process is to gain insight on a

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<sup>16</sup> J.D. Sterman (2000, vii); see also J.W. Forrester (1961 and 1968) and J. Richardson, Pugh A. (1981).

<sup>17</sup> The use of “microworlds” (S. Papert, 1980), also called “virtual worlds” (D. Schön, 1983), in particular, seems to be an important tool in order to boost the knowledge of operators and managers.

<sup>18</sup> J.D.W. Morecroft (2000, 3).

complex problem, at the same time influencing thinking and actions in management teams<sup>19</sup>.

In this regards, we have to stress that System Dynamics is to be preferred to other planning and control/simulation techniques whether there is the need to face the dynamic complexity of an issue.

Complexity generally arises because real (social and economic) systems are<sup>20</sup>: dynamic, tightly coupled, governed by feedbacks, nonlinear, history-dependent, self-organizing, adaptive, counterintuitive, policy resistant, characterized by trade-offs. Thus, it is a natural consequence of management that intended aims of actions carried out could not be reached or could provoke unanticipated effects. This is because real system are characterised by the presence of feedback loops. Actually, all dynamics arise from the interaction of just two types of feedback loops: positive (or reinforcing) loops and negative (or balancing) loops.

A *positive loop* tends to reinforce or amplify whatever is happening in the system. This feedback generates exponential growth as its dynamic behaviour: “the larger the quantity, the greater its net increase, further augmenting the quantity and leading to ever-faster growth” (Sterman 2000, 108).

A *negative loop* tends to counteract the tendencies within a system, opposing change and seeking for balance, equilibrium and stasis. This feedback operates to bring the state of the system in line with a goal or a desired state, counteracting any disturbance moving the system away from its goal. It generates goal-seeking as its dynamic behaviour, describing processes that tend to be self-limiting.

A variety of other dynamic behaviours arise from the nonlinear interaction of the above mentioned structures with one another.

The analysis of real systems is even more complex because they are governed by a plethora of players continuously interacting. Furthermore, these decision-makers generally base their decisions on their personal mental models of the real system surrounding them.

*Mental models* are extremely relevant when facing complex systems, characterized by a large number of feedback loops and by the presence of delays and nonlinearities.

The concept of “mental model” has been central to System Dynamics since its beginning in the Sixties because each decision is based on models, usually mental models.

“The term mental model means the conceptual model that each member of the management team carries in his or her head to explain the way the business (or more generally, the outside world) operates” (Morecroft 2000, 7). Furthermore, it “includes our beliefs about the networks of causes and effects that describe how a system operates, along with the boundary of the model (which variables are included and which are excluded) and the time horizon we consider relevant” (Sterman 2000, 16)<sup>21</sup>.

Thus, the real goal of methodologies such as System Dynamics could be that of expanding “the boundaries of our mental models so that we become aware of and understand the implications of the feedbacks created by the decisions we make. That is

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<sup>19</sup> The gain of a better insight and not the development of a predictive model is one of the fundamental aims of System Dynamics model. On this topic see J.W. Forrester (1961, 49).

<sup>20</sup> See J.D. Sterman (2000, 22).

<sup>21</sup> On the definition of *mental model* also see P.M. Senge (1992, 9); A.M.J. Vennix (1996, 21); C. Bianchi (2001, 51).

we must learn about the structure and dynamics of the increasingly complex systems in which we are embedded”<sup>22</sup>.

Particularly used in the form of Group Model Building, System Dynamics is a powerful tool that can be used in order to stimulate a process of organizational learning and in order to elicit the existing knowledge of the most important actors: in this way, knowledge can be obtained more quickly and for conditions not observable in real life.

In this regard, Vennix (1996, 3) underlines that “system dynamics can be used as a method to systematically elicit and share mental models in teams. The process of building a model starts from the different perceptions of the participants. One underlining idea is that people’s mental models are limited by human information processing capabilities. System dynamics can be helpful to elicit and integrate mental models into a more holistic view of the problem and to explore the dynamics of this holistic view”<sup>23</sup>.

This situation has led to a relevant change in the use that of System Dynamics and modeling techniques has been made over the past few years. In the last decades modeling and simulation have been generally seen as technical tools to be used to solve and get a better understanding about structured problems of prediction, optimisation and financial planning. On the contrary, more recently models have reached a different consideration: they are seen as instruments to support strategic thinking, group discussion and learning in management teams<sup>24</sup>. This situation is particularly relevant when the decision-makers have to deal with complex and persistent issues, whose effects will be experienced in the long period.

All the above mentioned considerations seem to be particularly evident with regards to the University management system.

On the topics presented in the previous table, we could also mention several System Dynamics applications and publications. For instance<sup>25</sup>:

- a) Governance: Kennedy and Clare (1999); Saeed (1996);
- b) Planning, Resourcing and Formula Funding: Galbraith (1998a; 1998b); Kennedy and Clare (1999); Bell, Cooper, Kennedy, Warwick (2000); Vahdatzad and Mojtahedzadeh (2000);
- c) Teaching and Research Assessment and Quality Assurance (TQM): Kennedy (1998a, 1998b);
- d) Microworlds: Barlas and Diker (1996); Barlas and Diker (2000);
- e) Enrolment Demand: Frances, Van Alstyne, Ashton, Hochstetler (1994).

This said, taking into account the considerations we have previously mentioned, we could propose the following table. It briefly presents the major issues that are currently occurring within the HE system and highlights some System Dynamics tools that could be used by academic players in order to better face complex and dynamic problems.

Of course, it is not a comprehensive summary of all the dynamic issues we could identify within a University system; it is just a first proposal about the role that System Dynamics could play in the HE sector.

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<sup>22</sup> J.D. Sterman (2000, 12)

<sup>23</sup> On the use of the Group Model Building technique see J.A.M. Vennix (1996); J.A.M. Vennix (1999); J.A.M. Vennix, D.F. Andersen, G.P. Richardson, J. Rohrbaugh (2000).

<sup>24</sup> See J.D.W. Morecroft (2000, 3); J.D.W. Morecroft, J.D. Sterman (2000); J.W. Forrester (1961, 49).

<sup>25</sup> Other contributions include the works by: N.H. Roberts (1978); K. Saeed (1990, 1997); C. Frances (2000).

TABLE 2. - Dynamic issues and System Dynamics tools/goals in Higher Education.

<i>Issue</i>	<i>Reasons for the intervention of System Dynamics</i>	<i>System Dynamics tools</i>	<i>Focus and Goal</i>
Governance	Complexity; Need for a system approach; Presence of behavioural side-effects; Short and long term effects of policies; Self-organizing sector, characterised by trade-offs.	Causal Loop Diagrams; Stock and Flow Diagrams; Boundary charts; Group Model Building sessions.	Strategic and long-term thinking; Organisational learning; Gaining insight; Development of a common understanding and of a holistic view; Inter and intra-organisational analysis.
Changes in Teaching and Research Sub-systems	Non-linear relationships; Presence of behavioural side-effects; Short and long term effects of policies; Self-organizing sector, characterised by trade-offs.	Causal Loop Diagrams; Stock and Flow Diagrams; Dynamic simulation models; Group Model Building sessions; Microworlds.	Organisational learning; Gaining insight; Discovering side-effects; Strategic thinking.
Planning, Resourcing and Formula Funding	Complexity; Presence of systemic archetypes; Non-linear relationships; History dependent sub-system; Behavioural side-effects.	Dynamic simulation models; Causal Loop Diagrams; Stock and Flow Diagrams; Microworlds.	Exploring complexity; Scientific and long-term thinking; Discovering side-effects;
Stakeholders relationships	Need for a system approach; Complexity; Policy resistant system.	Dynamic simulation models; Causal Loop Diagrams; Stock and Flow Diagrams.	Inter and intra-organisational analysis; Strategic and long-term thinking; Organisational learning; Gaining insight.
Evaluation and quality assurance	Need for a system approach; Presence of behavioural side-effects; Complexity; Short and long term effects of policies	Dynamic simulation models; Causal Loop Diagrams; Stock and Flow Diagrams; Microworlds.	Scientific and strategic thinking; Discovering long-term impact of policies; Identification of behavioural side-effects; Organisational learning.
Enrolment Demand	Short and long term effects of policies; Need for a system approach; presence of nonlinearities.	Dynamic models; Causal Loop Diagrams; Stock and Flow Diagrams; Microworlds.	Scientific and strategic thinking; Discovering long-term impact of policies; Gaining insight.

However, as it emerges from the literature review we have previously presented, many other scholars are stressing and underlining many dynamic and complex issues of the current HE scenario that would require the use of System Dynamics tools or other simulation techniques.

It is author's opinion that System Dynamics and System Thinking will progressively acquire a major role within the managerialization process of modern Universities and within a new re-shaped HE system.

#### 4. FINAL REMARKS

This paper dealt with the managerialization process which is occurring in many European and non-European universities and with its organisational and behavioural consequences. Indeed, the overall process is impacting on many sub-systems and

organisational variables of universities, consequently requiring several changes and adjustments.

Taking into consideration a review of the latest literature, we have highlighted the main strengths and weaknesses that many scholars have reported about the reform of the higher education system.

We have also argued that this massive reform is implying a change in the traditional *modus operandi* and core values of universities, now becoming sort of customer-oriented and revenue seeking enterprises.

This situation is significantly impacting on the decision-making process within universities, requiring academic players to adopt a long-term oriented approach to management and a strategic thinking about situations characterised by complex and dynamic issues.

We have consequently assessed that the transition to renewed managerial and organisational structures requires the adoption of methodologies and techniques once only used in the private sector.

It is author's opinion that simulation tools and techniques could provide a fruitful help to decision-makers. In particular, we have suggested the adoption of the System Dynamics methodology.

As previously mentioned, the System Dynamics approach is based on the concept of feedback and on information-feedback control theory and offers a comprehensive set of tools that enables decision-makers to understand the structure and dynamics of complex systems characterised by soft and hard variables and by nonlinearities.

In this regard, even the use of simple System Dynamics tools as a Causal Loop Diagram or a Stock and Flow diagram could provide useful information on the system in which academic players are embedded and let them gain deep insight on the long-term consequences of the actions carried out.

As stated, this approach could eventually facilitate a process of organizational learning, a positive change in the mental models of the relevant actors, the creation of a common understanding about systems characterized by the presence of feedbacks and complexity and an overall better management of the available resources.

This could be the path modern universities ought to follow in order to finally become "learning organisations" and to adopt a strategic, pro-active, long-term thinking.



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