
Universities' contribution to the national innovation system in the Maghreb states

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Abstract: Universities are called upon to play a vital role in Maghreb Countries (MCs). In a relatively short time, the countries will be fully opened through the Free Trade Agreement with Europe and will face tough competition. This article looks at the challenge they face in contributing to build an efficient National System of Innovation (NSI). It examines in depth the internal power game and the race to political positions which put scientific work and academic achievements in a secondary position. Rent seeking gradually becomes the dominant activity and consumes the largest share of valuable research time. Unless these issues are properly addressed, successive university reforms can have only limited results.

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1 Introduction

The bulk of scientific research in the Arab world is conducted within universities. This is also the case in the Maghreb region (Quasem, 2000). In the Maghreb Countries (MCs), universities are called upon to play a key role in the promotion of scientific research. Since the mid-1990s, Maghrebi universities and the higher education system as a whole have been undergoing reforms to comply with the changing role of universities across the world. This is part of an attempt to give a better place to universities in the new science and technology policies being initiated by governments. And yet, several years of university reforms appear to be far from satisfactory. In each country, universities have been producing substandard graduates, with relatively poor performances both in the workplace and in the sphere of research. Vast numbers of graduates do not find their way into the labour market (Alcouffe, 1996). Rates of unemployment are particularly high among engineers (Zahlan, 1999). Moreover, the economic sector as a whole suffers from deep shortages of competencies in all fields, and particularly in the industrial and technological fields. In each one of the three MCs, deeply rooted obstacles continue to marginalise the role universities play in the research field.

The numerous policies and projects put forward are not effectively implemented. In the eyes of society as a whole, the result is frustration, lack of credibility and loss of confidence in the public and economic role of the university to effect meaningful transformations. Consequently, the Maghreb region has one of the world's lowest rates of registered patents, despite devoting the largest share of the national budget to education and particularly to higher education (Quasem, 2000). This state of affairs seems to be

rooted in the complex and multifaceted realities in which the MCs have been over the last four decades. The aim of this article is to examine the intersection between higher education reforms and science policies in three MCs: Algeria, Tunisia and Morocco. We adopt concepts associated with the National System of Innovation (NSI) approach. Clearly, introducing NSI goes beyond the simple monitoring of linkages between various components and sectors in any particular national system. The relationship between regional and national systems of innovation also needs to be clarified and integrated into a comprehensive explanation of why some developing countries fail to introduce NSI. It is important to examine how globalisation and regional geopolitical processes affect the possibilities to build systems of innovation. The present article builds on the case of the MCs to explore these complexities within the context of regional and geopolitical dynamics which impact the development of NSI. We argue that these dynamics are associated not only with intranational power politics, but also with regional competition among Maghreb states, and, most important, with geopolitical processes associated with European Union (EU) policies targeting the Mediterranean region. Therefore, the first question raised in the present article focuses on the extent to which higher education governance reforms have made it possible to properly re-integrate the university into the national innovation system by addressing the impacts of power struggles. The second question relates to the prospect that Maghreb universities will be fully integrated into the EU regional innovation system.

Following this introduction, which raises the key issues and highlights the objectives of the paper, Section 2 will provide the theoretical framework for an extended NSI in the specific context of geopolitics and internal power relations. Section 3 will look specifically at the political, economic and institutional context of Maghreb universities and the impact on NSIs. Section 4 examines policy reforms and the new mode of governance in a context of power struggle and rent seeking. Section 5 looks at the Euro-Mediterranean relationship with MCs and their impact on building an extended NSI which properly integrates universities. Section 6 concludes.

2 The National System of Innovation, globalisation and regional politics: theories and conceptual framework and tools for less developed countries

Recent studies have identified a host of factors that clarify the complexities associated with the integration of learning and education systems in the NSI. Several analytical frameworks were put forward to that effect: the National System of Innovation and Competence Building (NSICB) (Lundvall *et al.*, 2002), Learning Systems, Learning Opportunities and Learning Culture (Archibugi and Michie, 1997), the National Learning System (Lall, 2003) and Interactive Learning Spaces (Arocena and Sutz, 2000). While these theoretical approaches contributed valuable elements to a more pragmatic and realistic understanding of the role of the university in developing NSIs, they remain limited in their explanatory power with regard to the challenges imposed by emerging paradigms and more open and globalised economic and networked research systems. Three spheres are identified in the basic model: the productive sphere, the training and education sphere, and the research sphere. The integrated approach to the NSI, however, was put forward by Lundvall (1985) and revised in the 1990s for Less Developed

Countries (LDCs). The university, while belonging to the education sphere, takes on a particular importance, as it has done in the face of a weak productive sector, and largely incorporates the research sphere. This is the case of the MCs, where up to 80% of scientific research is conducted within universities and the higher education institutions in general. The merit of the NSI is that it is capable of creating the conditions for generating, sharing and disseminating the appropriate knowledge conducive to quick learning and the innovation necessary for speedy catching up and growth. Moreover, the system thrives in the breakdown of the monopoly culture of rent-seeking vested interests, and in the liquidation of the political culture of a centralisation of power, which underlies the state of institutional fragmentation observed in developing countries. It views innovation as a product of a complex and nonlinear set of activities involving interactions within and between the principal players. It can be seen as deriving from a combination of both continuous and discontinuous innovation based upon previous learning and experiences, but also requiring a significant level of 'unlearning' and a new 'way of doing things' – what Schumpeter refers to as 'creative destruction' (Zawdie *et al.*, 2005). A system-of-innovation perspective appears to constitute a useful framework for thinking about how to generate sustainable linkages of the regional economic pole (which is Europe in our particular case) with the region of its influence, and together with the world economy. There are thus two types of linkages (Angathevar and Muchie, forthcoming) occurring simultaneously:

- 1 the regional pole's striving to have a substantial presence in the region where it is geographically located in order to operate effectively through regional linkages
- 2 the linkage to the world economy by increasing the opportunities for competitive advantages.

The interesting question is whether the regional pole interacts with its region by sharing knowledge, learning and capacity building, or does it relate to it very much by pursuing its own interests in the region as it does anywhere in the world? The Regional Innovation System (RIS) can be thought of as the institutional infrastructure supporting innovation within the production structure of a region. Several types of national innovation systems can be identified according to their level of integration with the RIS: territorially embedded RISs, regionally networked innovation systems and regionalised NSIs.

Networking appears to be a key element for ensuring the attainment of effective and rapid learning through proximity and collaboration between the main actors or institutional spheres, much in the same way as the triple helix system (Etzkowitz and Leydesdorff, 1997; Etzkowitz, 2003). The interaction that takes place can promote learning and an innovative production exchange, and facilitate value-added manufactures and service exchanges. The relationship is thus transformative and is more likely to include developmental features. However, this may not always be the case. The weakest and least developed partner can be locked in a regional arrangement where the dominant pole has preponderant economic power. The main goal of the regional pole in this particular case is to improve and build its competitive advantage especially in relation to the established players within the world economy, regardless of the spillover which may or may not occur for the weak partners.

From this perspective, the international sphere takes on a particularly central position to the extent that it could be called a 'fourth pole' of the NSI. The kinds of relationships which the system manages to build with this international sphere can determine to a large

extent the coherence and the integration of the system and therefore its efficiency in promoting innovation dynamics within the least developed partner. This is even more so when Transnational Corporations (TNCs) in particular are increasingly playing a central role in shaping and influencing R&D trends in the world economy (Madoeuf *et al.*, 1997).

3 The political, economic and institutional context of Maghreb universities

The Maghrebi higher education sector has been suffering from a host of problems and obstacles since it was set up back in the 1960s. As pointed out in a recent report (World Bank, 1998) on Tunisia, these obstacles can be grouped into four categories:

- 1 a weak internal efficiency
- 2 a structure that misallocates resources, delegating little and disdaining the outside world or private initiative
- 3 an instruction characterised by weak statutory time requirements, inappropriate recruitment and promotional criteria, the devaluation of the teaching profession and the absence of educational training and evaluation
- 4 a financing that is almost exclusively public, burdened by the costs of important but inefficient transfers.

The lack of a clear vision regarding the role of the university in the promotion of scientific and technological research has prevailed (El Aoufi, 1995). Higher education has often been used as an instrument to legitimise political regimes and power elites. Whenever research initiatives were taken outside the control of the state, indirect measures were applied to discourage them. These measures ranged from the provision of a poor research environment and negligible budgets to a total lack of recognition. This lack of autonomy meant that no independent scientific research could take place. Lack of freedom also meant lack of freedom to take initiative, generate new creative ideas and introduce innovations. The university has thus passively absorbed the political orientations and political guidelines to which it was subjected. The ultimate research which seems to commend any kind of recognition is that which strengthens the position of power groups. Competition within academic circles is not for the acquisition and production of knowledge, but rather in view of holding positions in politics or benefiting from its material gains. One of the worst losses is thus caused by domestic brain drain, in which thousands of academics and sometimes experienced professionals are driven away from the area of scientific research (Djeflat, 2002). This dynamics has produced heterogeneous groups within the university which are often opposed to each other in their competition over political positions and material gains, with wasted effort and energy at the expense of research. Relatively poor salaries and dwindling standards of living have led to a massive exodus from academic research to pseudobusiness activities. Corrupt and unethical behaviour has deeply penetrated university life. Rent seeking on the part of academics has often strengthened mediocrity and discouraged initiatives in the scientific sphere. Within such an inefficient and nonmeritocratic reward system, the emergence of brilliant competencies and excellence in research has largely been inhibited (Djeflat, 2002). The political game goes as far as inhibiting the formulation of personal views and

arguments in the public debate whenever it takes place. A system of self-censorship has been established and strengthened, making the prospect for social change relatively low. The university has thus been absent from major public debates of fundamental importance to the economies and societies of the Maghreb. Self-censorship has become a cult, whatever its basis. It could be the fear of unpleasant consequences coming from the Maghzen (the royal power) in Morocco, from the ruling party in times of a one-party system in Algeria or from the strict ruling regime in Tunisia. It could be part of individual strategies in the hope of being considered for a power position in a future government reshuffle. It must be noted that Maghreb governments have largely involved academics in their teams. The political game is equally used to have access to the limited means and resources made available where rationing and queuing for access to them are part of the general rule. Good positioning in the waiting list is not fostered by any academic distinction and intrinsic value, but by the closeness to the local decision-making body. This also explains, to a large extent, the race to hold positions in the running of faculties and universities as Dean, Head of Department, President or Rector. As mentioned by Henry Kissinger, "University politics are vicious precisely because the stakes are so small." The quest for good administrative positions mobilises a great deal of energy and times, which are taken from pedagogical and research activities. "The petty retributions, discriminations, calumnies, character assassinations, and herding attacks are most often abuses of power in the cause of self-promotion and aggrandizement. It is the politics of the herd and lower forms of bottom dwellers, but politics nonetheless", as quoted from Visentin (2005) analysing Canadian universities. This applies to a large extent to Maghreb universities.

Politics also comes fully in university life through student organisations, where the student movement is sometimes aligned with political parties in the arena of political competition whenever the political game is open, like in Algeria. For instance, the Union Générale des Etudiants Libres (General Union of Free Students) and the Islamic Students Movements of various affiliations are closely linked to political parties. Wherever the political game is closed, the dominant student movement tends to be aligned with and develops 'allegiance' to the dominant political party. The Union Générale des Etudiants Tunisiens (General Union of Tunisian Students) is close to the ruling party, the Rassemblement Constitutionnel Démocratique (RCD), in Tunisia. The overly protective central power structure serves both to limit individual independence starting from childhood, especially for girls, and to foster passive attitudes and lack of decision-making skills (UNDP, 2003). Likewise, government bureaucracies are slow in applying new instruments and solutions in public services and in diffusing information (Aubert and Reiffers, 2003). The university finds itself in a paradoxical situation whereby it has relatively little room for manoeuvre, yet when new syllabi or programmes are introduced, very little useful guidance is provided regarding implementation, leaving wide margins for interpretation. The Comités Pédagogiques Nationaux (CPN), established to decide the syllabi and to monitor their implementation, are often ignored by universities and faculty members, drastically reducing their usefulness.

From a governance point of view, including control of corruption, rule of law and the effectiveness of public institutions, MCs are better off than Latin American ones (Andersson *et al.*, 2005). However, political openness and accountability are generally low. Being entirely dependent on the state budget, universities are totally controlled by the central government. They have very little room for manoeuvre in spite of all the

measures taken in recent years to provide them with more say in the allocation of the budget. Often, when other opportunities are found to raise funding by faculty members, notably through expertise and research projects, the complex procedures, often inherited from the French system, make it impossible to use these resources within a reasonable period. While these procedures aim to ensure the good use of public money, in reality they represent a technique to better control university life and orient its trajectory. Over the years, the dwindling academic standards have reduced access to international academic refereed journals and prevented the creation of local ones. This has often led promising scholars to publish in local and national newspapers. Often, self-censorship and political ambitions tend to reduce these contributions to mere validations of current government policies. Consequently, genuine and competent researchers, who could shape public opinion, tend to shy away from the public eye, often at a heavy social cost.

4 The impact of the political, economic and institutional context on university integration into NSI

From an NSI perspective, it is possible to argue that Maghreb universities have not been able to properly integrate innovation systems nor to play a key role in the promotion of scientific research as part of broader policies on development. Three factors have contributed to this exclusion.

Firstly, the *poor linkages between the world of learning and the world of production and research*: Efforts to link the world of learning to the world of industry and research have generally been limited in scope and effectiveness (Khalifaoui, 1996). Over the years, MCs have made huge efforts to remedy the situation of shortage of scientific capabilities by reinforcing the training of graduates in the belief that the higher education level is central to skills formation and creativity, both necessary ingredients for innovation. Nonetheless, there is no significant evidence that higher education helped to meet the needs of the industry through the production of relevant skills and the provision of R&D support. Educational policy was not matched with economic policy in the face of reduced employment opportunities and immigration to skill-deficit economies, thus reinforcing the brain drain phenomenon. As numerous studies show (Djeflat, 1996), there were many regional 'missed opportunities' as a result of the isolation of the university from the economy as a whole. 'Market failure' and the absence of private initiatives meant that limited demand for technical change involving universities took place domestically. In recent years, timid but growing ties have been established between universities and enterprises, but they often rest on personal ties and relations rather than institutionalised programmes. Their impact on the community remains limited as a result.

Secondly, the *paucity of outward-looking research*: In the face of an absence of proper incentives, locally undertaken academic research either addresses fundamental and abstract topics unrelated to local needs or is conducted in collaboration with foreign counterparts and leads to joint publications in foreign journals and reviews. On top of that, reportedly, faculty involved in academic research do not devote more than 10% of their time to effective research as a result of pressure from overcrowded faculties and amphitheatres and heavy teaching loads. Published articles in refereed journals are often undertaken in collaboration with foreign institutions, mainly in France. Scientific research suffers from a high degree of 'externalisation' (Driouchi and Djeflat, 2004), with the consequence of further disintegrating Maghreb NSIs.

Thirdly, the *brain drain phenomenon*: MCs have been relying on the specialised education and training facilities of European institutions and to a lesser extent on US ones to train students, particularly at the postgraduate level. Maghrebi students are found in 45 countries with a large concentration in France (67% of the total). This strong dependence on France raises several specific problems related to the French higher education system, which is oriented towards teaching and the liberal professions, and less towards the industry and the productive sphere. Many academics have left at the height of their career and at a time when they could fully contribute to strengthen national research potential. For instance, the number of researchers who left Algeria since 1967 reached 280 000 (El Watan, 2006).

It should be acknowledged that additional factors, operating outside the control of universities, have further contributed to the exclusion of universities from the NSI. These include the abuse of packaged forms of contracts of technology acquisition, which we call the *ultimate institutionalised form of university exclusion* (Djefflat, 1992). Indeed, the industrialisation of MCs started in the early 1970s and has led to massive imports of machinery, equipment and plants, using fully integrated forms of contracts through which all parts and components and all technological services are packaged in a single bundle. This has left little opportunity for local industry to do any adaptation work and for any local expertise to be involved in the various technological choices and decisions made at the various stages of this process. This has continuously excluded universities from all major technical changes occurring in the productive sphere (Djefflat, 1998). The unbalanced power structure operating in favour of technology suppliers leads, as we have shown previously, to the disintegration of NSI (Djefflat, 1988). Moreover, the limited outsourcing of local R&D by TNCs, and its concentration in more developed economies, often inhibits the development of local research capabilities and the scientific community. Finally, we can mention the dominant external funding in the technological acquisition process, particularly for non-oil producing MCs (it reached up to 60% of the total research budget in some areas, such as agriculture and health). This has inevitably led to the structural dependence of the national research systems. Consequently, the latter were unable to take off by themselves, thus becoming permanent 'infant research sectors'. External debts and Structural Adjustment Programmes have contributed to worsen the situation (Djefflat and Boidin, 2002; Enos, 1995).

5 Reforms and the integration of the university into the NSI

In recent years, sweeping reforms have been introduced in all three MCs to reshape scientific research in a fundamental way in order to increase its efficiency. These reforms restructured the higher education landscape by introducing new models of governance and private higher education and by placing greater emphasis on the development of science and technology research. In Tunisia, a comprehensive set of reforms took place in the early 2000 and was updated in 2005. The measures taken relate to the updating of the orientation law of scientific research, the transformation of the research centres, the improvement of the status and mobility of researchers, and the allocation of subsidies to research laboratories and centres. While the real impact of these new reforms remains to be seen, the results achieved so far question profoundly the effectiveness of previous reforms in the face of persistent problems, notably those related to poor research

performances. In Algeria, the 1999 reforms encouraged universities to forge links with the industry and to partner with actors in the local environment in order to play a more active role in national development. The number of researchers increased from 5000 in 1996 to 15 000 in 2002. With the 1999 reforms, S&T policy shifted from a centralised to a decentralised approach and institutional networks emerged through a greater community involvement of universities in liaison with local actors. This process involved relationships and joint actions within and between government, industry, university and research institutions, both at national and regional levels. Such networks and relationships helped promote innovation through knowledge creation and dissemination. However, the reform did not provide for sufficient power to be devolved to local actors, so that the potential gains derived from the articulation of institutional networks is still far from fully realised. In terms of concrete results, research budgets have grown threefold in MCs and officials have been lurking at their Scientific and Technological Diasporas (STDs) more intensely than in the past. Indeed, following the growing needs for research and the problems met locally, all three MCs have initiated programmes to involve their STDs in a more significant way. Morocco has implemented a specific policy initiative, the Forum International des Compétences des Marocains résidents à l'Etrangers (International Forum of Moroccan Competences Living Abroad – FINCOME) programme to draw on Diasporas abroad, with the financial help of the UNDP programme called the Transfer of Knowledge Through Expatriate Nationals (TOKTEN). This programme aims at transferring scientific and technological knowledge through nationals of LDCs living abroad, namely from Africa, Asia and Latin America. In Tunisia, the Ministère de la Recherche Scientifique et Technologique et du Développement des Compétences (Ministry of Scientific and Technological Research and the Development of Competencies – MRSTDC) launched its 'Programme de Coopération avec les Chercheurs Tunisiens Résidents à l'Etranger' (Cooperation Programme with Tunisian Researchers Living Abroad). Algeria developed a new strategy to mobilise its Diasporas in 2006 by encouraging them to form networks, while many nongovernmental initiatives have been taken by the Diasporas themselves, such as the Réseau des Etudiants Algériens des Grandes Ecoles (Algerian Network of Graduates from Grandes Ecoles – REAGE), to encourage its contribution to teaching and research in home universities. This new drive is also inspired by the success stories of Diasporas' involvement in home-country development and growth from countries such as in South East Asia, namely India, China and South Korea.

Nonetheless, the question remains regarding the extent to which higher education governance reforms have made it possible to properly re-integrate the university into NSIs. When looking closely, one cannot help position the intersection between Maghreb higher education reforms and science policies over the political and social configurations within which research institutions operate. The latter cannot be dissociated from the power dynamics associated with development. This undoubtedly has a nonnegligible impact on the intersection between university reforms and the role of Maghreb universities in the promotion of scientific research for development. In effect, reforms are linked to the opening of the democratic field to academics and the setting up of evaluation mechanisms (Harzallah, 2006). Two factors constitute a stumbling block. First, the dominant role of the state, its centralised approach and its lack of a knowledge-sharing culture, complicate coordination between the various components of the NSI, rendering goals unattainable (Zawdie, 2002). Democratising and empowering the university community to be more creative and innovative could lead to questioning

the established power structure and its legitimacy. While the means towards that end can be provided and the bureaucracy addressed to some extent, it is obvious that the decision-making space is far from being shared. Still there has been a great deal of progress made in recent years. Taboos have been lifted on issues which, until recently, remained outside the public debate, like human rights, citizenship, democratic participation and corruption.

Secondly, rent seeking hampers university life and research in particular. Over the years, it has encrusted the behaviour of academics and is considered in some countries as a 'normal' phenomenon. Rent seekers are found in every position and at whatever status or ranking. It takes the form of holding permanent tenured positions not on the basis of academic achievement and excellence, but on the basis of academic titles and a set of personal strategies and tactics to protect the position: limiting and controlling information diffusion, discouraging new initiatives and ideas on the part of junior members and promising young doctorate holders. This tends to encourage the constitution of clientelism, herds and groups. Moreover, rent-seeking behaviour contributes to freeze or even destroy local research competencies, initiatives and capabilities (Djefflat, 1999; Carré, 2001). Rent seeking on the part of academics leads to a lack of transparency in the use of the university budget, preventing the evaluation of scientific work by external bodies and the sharing of networks. In such circumstances, rent seeking constitutes one of the most formidable stumbling blocks in the face of whatever reforms may be undertaken. For many years, this phenomenon negatively affected national projects by preventing the return or even simply the involvement of the members of the STDs living abroad and who have shown, on several occasions, their willingness to take part in the uplifting of university research and teaching. The situation is, of course, a lot worse for researchers who sought asylum in Europe and elsewhere and sometimes joined the opposition and whose return is currently inconceivable under the current political situation. Nonetheless, this category of researchers constitutes only a minority. While the democratic field has made real progress in recent years, particularly in Algeria and to some extent in Morocco, the rhythm of the political and constitutional reforms undertaken is still relatively slow.

6 Conclusion

Through this analysis, we have attempted to reflect on the place and role of Maghrebi universities in facilitating and promoting integrated NSIs that are up to the challenges of the Maghreb economies. While human potential exists within these universities, the political relations to power, both internally and in relation to central government, hamper this integrative role to a large extent, despite all the efforts invested to provide new impetus to research in the Maghreb. Decision making decentralisation and power sharing are still difficult to bring about. The prospects of regionalisation with Europe and the new free trade zone, while opening up new horizons, have yet to link MCs to the much broader European Innovation System. The lack of autonomy and the submission of Maghrebi universities to political influences mean that they are very dependent upon the relationships which the EU and the Maghreb have and the way these relations evolve in the future. As an illustration, when these relations go through difficult times and are tense, university students and academics find their mobility to Europe restricted and vice

versa. Scientific research in Maghrebi universities will depend greatly, not only on their capability to integrate with European research networks, but also on the quality of the political relationship and political will of northern partners. Geostrategic considerations, while supporting the idea of an effective Euro-Mediterranean innovation space, have a countervailing force associated with how policy makers perceive the EU's security. The emergence of Asian countries on world markets and the US Great Middle East initiative could present alternatives that would ultimately force the EU to effectively and politically look south, to the Maghreb.

References

- Alcouffe, A. (1996) 'National innovation systems: the case of the Arab Maghreb Union', in G. Zawdie and A. Djeflat (Eds.) *Technology and Transition: The Maghreb at the Crossroads*, London, UK: Frank Cass.
- Andersson, T., Djeflat, A. and Johansson de Silva, S. (2005) 'The Moroccan National System of Innovation', Unpublished report, University of Jönköping, Jönköping, Sweden.
- Angathevar, B. and Muchie, M. (forthcoming) *Neighbourhood System of Innovation: Regional Poles as Dynamos for Economic Development*, London, UK: Adonis-Abbey Publishers.
- Archibugi, D. and Michie, J. (Eds.) (1997) *Technology, Globalisation and Economic Performance*, Cambridge: Cambridge University Press.
- Arocena, R. and Sutz, J. (2000) 'Interactive learning spaces and development policies in Latin America', *The Druid's Summer Conference on Learning Economy*, Rebild, Denmark.
- Aubert, J-E. and Reiffers, J-L. (2003) 'Knowledge economies in the Middle East and North Africa: toward new development strategies', World Bank Report: The World Bank, Washington, DC.
- Carré, H. (2001) 'L'innovation Technologique dans une économie de rente: le cas de l'agro-alimentaire au Sénégal' (Technological innovation in a rent-seeking economy: the case of Agro-Food in Senegal)', PhD thesis, Lille, France: University of Lille.
- Djeflat, A. (1996) 'Input-output analysis and the prospects for innovation in LDCs: the case of Algeria', *Innovations*, Vol. 1, No. 3, pp.111–133.
- Djeflat, A. (1988) 'The management of technology transfer: views and experiences from developing countries', *Int. J. Technology Management*, Vol. 3, Nos. 1–2, pp.149–166.
- Djeflat, A. (1992) *Technologie et système éducatif en Algérie (Technology and the Education System in Algeria)*, UNESCO/CREAD/Medina, Algiers-Paris.
- Djeflat, A. (1998) 'High technology buying in low technology environment: issues in new market economies', *Industrial Marketing Management*, Vol. 27, No. 6, pp.483–496.
- Djeflat, A. (1999) 'L'échec de la régulation rentière et les difficultés du modèle néo-libéral', in A. Djeflat (Ed.) *L'Algérie: Des principes de novembre à l'ajustement structurel (Algeria: from November Principles to Structural Adjustment)*, CODESRIA, Karthala, Paris.
- Djeflat, A. (2002) *National Innovation Systems in the MENA Region*, World Bank, Washington, DC: World Bank Publications.
- Djeflat, A. and Boidin, B. (2002) *Ajustement et Technologie en Afrique (Structural Adjustment and Technology in Africa)*, Paris: Publisud.
- Driouchi, A. and Djeflat, A. (2004) *Le Maroc dans l'Economie de la Connaissance (Morocco in Knowledge Economy)*, Ifrane, Morocco: AlAkhawayn University Press.
- El Aoufi, N. (1995) 'L'entreprise marocaine et la gestion des relations professionnelles: le dilemme du prisonnier (The Moroccan enterprise and the management of professional relations: the prisoner's dilemma)', in A. Djeflat and R. Zghal (Eds.) *Science, Technologie et Croissance au Maghreb (Science, Technology and Growth in the Maghreb)*, Biruni, Sfax, Tunisia.
- El Watan (2006) Algiers, 24 June.

- Enos, J. (1995) *In Pursuit of Science and Technology in Sub-Saharan Africa: The Impact of Structural Adjustment Programmes*, London, UK: Routledge.
- Etzkowitz, H. (2003) 'Innovation in innovation: the Triple Helix of university-industry-government relations', *Social Science Information*, Vol. 42, No. 3, pp.293–337.
- Etzkowitz, H. and Leydesdorff, L. (Eds.) (1997) *The University in the Global Knowledge Economy*, London/Washington: Pinter.
- Harzallah, A. (2006) 'L'enseignement supérieur: au coeur du LMD (Higher education: at the heart of the LMD)', *La Tribune*, 10 September, Algiers, Algeria.
- Khalfaoui, H. (1996) 'Les conditions d'émergence d'une communauté scientifique en Algérie: savoir et pouvoir de 1962 à 1992', *Cahier des Sciences Humaines*, Vol. 32, No. 3, pp.611–628.
- Lall, S. (2003) 'Indicators of the relative importance of IPRs in developing countries', *Research Policy*, Elsevier, Vol. 32, No. 9, pp.1657–1680.
- Lundvall, B.A. (1985) *Product Innovation and User-Producer Interaction*, Aalborg, Denmark: Aalborg University Press.
- Lundvall, B.A., Johnson, B., Andersen, E.S. and Dalum, B. (2002) 'National system of production, innovation and competence building', *Research Policy*, Vol. 31, pp.213–231.
- Madoeuf, B., Lefebvre, G. and Savoy, A. (1997) 'De L'internationalisation à la Globalisation de la R&D Industrielle: l'exemple de la France (From internationalisation to globalisation of industrial R&D: the case of France)', *Innovations*, Vol. 5, pp.52–99.
- Quasem, S. (2000) 'Research and development in the Arab states: a new commitment', Paper presented at the *Expert Group Meeting on New Science and Technology Initiatives*, ESCWA, Beirut.
- UNDP (2003) *Human Development Report*, New York: Oxford University Press.
- Visentin, L.P. (2005) 'Politics in the university', *Ecclectica*, Brandon University, <http://www.ecclectica.ca/issues/3/>.
- World Bank (1998) 'Higher education in Tunisia: issues and prospects', The World Bank Economic Report, The World Bank, Washington, DC.
- Zahlan, A. (1999) 'Science policy for the twenty first century: mobilisation and development', ESCWA, Beirut, Lebanon.
- Zawdie, G. (2002) 'Strategies for science and technology-based development and transition: the Maghreb perspective', in G. Zawdie and A. Djeflat (Eds.) *Technology and Transition: The Maghreb at the Crossroads*, London, UK: Frank Cass.
- Zawdie, G., Derbal, A. and Lee, R. (2005) 'Issues and challenges arising from a greater role of the university in promoting innovation in developing countries: a comparative study of experiences in Malaysia, Algeria and Ethiopia', Working Paper ID: A321, Strathclyde University, UK.