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Assessment: the Center for Logic and Computation  
Report 2003 // Plan & Budget 2004

#### Overview

The centre develops a very active research work in various directions concerning Logic, Computation and Information, broadly construed. His 14 members have produced about 20 publications, some of which on leading international journals and conferences. I am particularly impressed by the large amount of invited guests and seminars organized in 2003: about 50 lectures scanned the year in three different areas, such as the Logic and Computation, Quantum Information and Algebra. Members of the center coordinated or participated to 7 national or international projects, supported by various institutions; some of them deserve a particular attention in view of their promising role in computing and information.

#### Research Themes and Perspectives

Combined or mixed logic systems remain the main research interests of the leading group of the center. This is a highly technical topic: it requires an insight in (very) different logical systems, a deep knowledge of their main results and an insight into their possible practical applications. Thus, Computer Science applications must join relevant logic backgrounds. One major technique used is "fibring", a powerful form of combination of logic which enhanced strongly the research area. Indeed, it is a fact that programming languages (like ordinary languages) hardly stick to one method or accept a unique frame. The possibility of combining deductive and computation techniques enrich the freedom and effectiveness of computations: in natural languages, we always switch from a logic to another, from a meaningful linguistic frame to another and surprisingly preserve coherence (well, most of us), this is why spoken logic is so effective, understandable and comprehensive. Sometimes we would like to do it in computational frames, but a formal unity is required (since machines are stupid, this is why we need so much work and logics in programming): the approaches proposed are driving us to this, while preserving completeness as well.

At least two projects (Mikado and Mimo) deal with distributed and mobile systems and computation. Another hot topic, which requires both a mathematical insight and a robust implementation experience (both available within the Center). Logics for the verification and security of protocol are also studied (Profundis), along the lines of relevant work on authentication and secure computation.

The research themes seem well chosen and, what's more relevant, they lead to the interesting work, witnessed by the publications. I would put more emphasis in the novel area recently started, Quantum Computation: this seems to be leading mankind to a radically new understanding of information and computation. Even though we have no idea whether and when an actual quantum

computer will be available, the work in the area is contributing both at a further understanding of Quantum Mechanics and may provide a different insight in traditional computing (at least, for example, it finally gave us true random generators). I would strongly recommend further work in this direction; as for the associated logics, more than the systems that are currently in fashion, it may be wise to follow up the ongoing work by J.-Y. Girard in the area.

As I said above, the international connections are excellent and they are well reflected on guests, events, talks and travels. Perhaps the ratio Ph.D. students / tenured researchers is rather low and improving it should be a priority in the development of the Center. Of course, I understand that this may more depend on the financial support, by grants and Ph. D. funding, than on the talents of attracting students by the members of the Center. An effort though should be made in this direction.

As for the planned activities, the first theme, Abstract deductive systems, and the fourth, Type theory, constructive mathematics and mobile computation, seem promising developments of well established (though recent and relevant) research areas. Thus they are well organised and feasible plans. The novelty of the other two areas, Probabilistic and quantum computation and information and Dynamical systems and computational complexity, better correspond to an audacious attempt to move away from classical themes and should be particularly encouraged in a theoretical research center.

The funds requested or expected seem very modest w.r.t. the breath and originality of the projects, but correspond to our european tradition: we invent a lot with very little. In my recent evaluation visits in Portugal, I was particularly impressed by the very high derivative of portuguese theoretical research: the (the relatively modest) european and national funding has been used with the highest productivity. I have the impression that this Center will continue this tradition.

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