GEN-AU
GENOMFORSCHUNG IN ÖSTERREICH

Österreichisches Genomforschungsprogramm

Programmmanagementevaluierung

DAS ZUKUNFTSMINISTERIUM

bm:bwk

IMPRESSUM

Bundesministerium für Bildung, Wissenschaft und Kultur
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VORWORT

Mit der Empfehlung des Österreichischen Genomforschungsprogramms GEN-AU durch den Rat für Forschung und Technologieentwicklung konnten im Sommer 2001 zusätzliche 31,7 Millionen Euro für die Forschung im Bereich der Life Sciences zur Verfügung gestellt werden. Daher wurde am 7. September 2001 das GEN-AU Programm zum ersten Mal ausgeschrieben. Seit dieser Ausschreibung hat sich das Programm weiterentwickelt und fördert nun 12 naturwissenschaftliche Projekte und 6 Projekte, die sich mit ethischen, rechtlichen und sozio-ökonomischen Aspekten der Genomforschung beschäftigen (ELSA-Projekte). Auch Öffentlichkeitsarbeit, Technologietransfer und Nachwuchsförderung sind zentrale Bereiche im GEN-AU Programm.

Vor Start der zweiten Programmphase war es dem Bundesministerium für Bildung, Wissenschaft und Kultur ein Anliegen, das Programmmanagement von GEN-AU einer Evaluierung zu unterziehen, um fest zu stellen, ob es in seiner jetzigen Form weitergeführt werden soll und welche Prozesse und Abläufe in Zukunft verbessert werden müssen. Das Programmdesign und -management wurde deshalb einer kritischen Prüfung unterzogen.

Der Auftrag zur Evaluierung wurde in einem Verhandlungsverfahren ohne vorherige Bekanntmachung im Unterschwellenbereich (§26/(3)/1. BVergG 2002) an ein Konsortium bestehend aus den Partner Joanneum Research, TIA Consulting, Inc. und KMU Forschung Austria vergeben. Dieses Konsortium hat die Evaluierung von GEN-AU mit großer Sorgfalt durchgeführt und wertvollen Input für die weitere Entwicklung des Programms geliefert. Weiters wurden Richtlinien für eine zukünftige inhaltliche Evaluierung und Wirkungsanalyse des Programms erarbeitet. Diese Erhebung wird im Jahr 2007 durchgeführt werden.

Der vorliegende Evaluierungsbericht stellt dem GEN-AU Programm ein gutes Zeugnis aus und gibt eine klare Empfehlung zur Weiterführung ab.
Das Programm nimmt nach nur drei Jahren Laufzeit bereits eine bedeutende Rolle im Bereich der Life Sciences ein. Es trägt durch seine langfristige Orientierung und dem hohen Budgetvolumen zu jener Kontinuität bei, die von Forschenden eingefordert wird. Eines der Hauptziele des Programms, die Vernetzung der Genomforschung in Österreich, wird im Rahmen des Programms in hohem Ausmaß erreicht, zusätzlich bietet das Programm auch Möglichkeiten für darüber hinausgehende nationale und internationale Kooperationen. Sehr erfolgreich sind auch die zusätzlichen Aktivitäten des Programms,

besonders hervorgehoben werden Maßnahmen im Bereich der Nachwuchsförderung wie die GEN-AU SummerSchool und das GEN-AU Mobilitätsprogramm.

Sehr ernst genommen werden die im Evaluierungsbericht enthaltenen Empfehlungen zur Weiterentwicklung und Verbesserung des GEN-AU Programms. Ein großer Teil wurde bereits umgesetzt oder befindet sich gerade in Umsetzung.

Der Wissenschaftliche Beirat wurde neu zusammengesetzt und dadurch eine klare Abgrenzung zu den Antragstellerinnen und Antragstellern gewährleistet. Wissenschaftliche Qualität bleibt wichtigstes Kriterium bei der Auswahl der Projekte. Projektformen, die in der ersten Phase nicht explizit ausgeschrieben wurden, die sich aber in der Praxis bewährt haben, werden nun als eigene Projektschiene etabliert (Netzwerke, Pilotprojekte). Die empfohlene Übergabe der Programmabwicklung an eine Agentur wird bereits diskutiert.

Der vorliegende Evaluierungsbericht ist eine der Maßnahmen, die während der geplanten Projektlaufzeit von insgesamt 9 Jahren eine regelmäßige Anpassung des GEN-AU Programms an die nationalen Anforderungen gewährleisten sollen und wird somit signifikant zum Mehrwert des Programms beitragen.

Das Programmbüro GEN-AU im bm:bwk

JOANNEUM RESEARCH

TIA Consulting, Inc.

KMU FORSCHUNG AUSTRIA
Austrian Institute for SME Research

'Austrian Genome Research Programme GEN-AU': Mid Term Programme Management Evaluation

Final Report

Vienna, June 2005

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Executive Summary

Im Jahre 2001 startete das bm:bwk, das Bundesministerium für Bildung, Wissenschaft und Kultur, das österreichische Genomforschungsprogramm GEN-AU, das auf einen Zeitraum von neun Jahren und in drei Phasen angelegt wurde. Mission dieses Programms ist die Stärkung und Vernetzung von Genomforschung in Österreich. Pro Jahr sollen in etwa € 10 Mio auf verschiedene Projekttypen (von großen Verbund-, über Netzwerk-, Pilot- bis hin zu sozialwissenschaftlichen Begleitforschungsprojekten), die sich allesamt in ihrem Anspruch, in der Anzahl der Projektpartner, ihrer Dauer und ihrem Volumen unterscheiden, ausgeschüttet werden. Insgesamt werden in der ersten Phase von GEN-AU 23 Projekte bzw. 91 Partnerorganisationen mit 27,8 Millionen gefördert; vorrangig sind Wiener Forschungseinrichtungen Förderempfänger, jedoch auch zahlreiche Forscher/innen in Graz, Innsbruck und Linz zählten zu diesem Kreis.

GEN-AU ist aus mehreren Gründen in der österreichischen forschungs- und technologiepolitischen Landschaft wenn nicht allein stehend, dann doch besonders:

- Neben dem Kernziel, das sich auch als die Förderung von hochqualitativer Forschung umreißen lässt, verfolgt man auch eine ganze Reihe flankierender Ziele, die zum Teil auch auf der Maßnahmenebene Entsprechung finden: etwa im Bemühen um den Forscher/innennachwuchs (Summer Schools für Schüler/innen) oder um das öffentliche Ansehen der Genomforschung in Österreich im Generellen.
- Auch wenn es, zumindest nach Ansicht vieler Wissenschaftler/innen, nie genug Geld für Forschung geben kann, darf man nicht aus dem Auge verlieren, dass GEN-AU mit etwa € 10 Mio pro Jahr das größte thematische Programm in Österreich ist und – zum Vergleich – immerhin über ein Zehntel des Budgets des Wissenschaftsfonds FWF verfügt.
- GEN-AU ist Österreichs einziges thematisches top-down Programm, das diesen „top down–Charakter“ auch in letzter Konsequenz verfolgt und lebt. So belässt man es nicht dabei, ein Thema und einen Projekttypus vorzugeben und zu definieren, vielmehr hat das über die Vergabe entscheidende Gremium, der wissenschaftliche Beirat (SAB), sich vorbehalten, auch direkt in Projekte, deren Zusammen- und Aufsetzung einzugreifen und somit eine Richtung vorzugeben, in die man das Programm und Genomforschung in Österreich im Allgemeinen lenken möchte. Das SAB ist also viel eher als ‚Steuerungskomitee’ denn als ‚Jury’ im herkömmlichen Sinne zu verstehen. Dies ist (für Österreich) mit dieser Konsequenz neu, dies ist hochriskant, nichtsdestotrotz ein legitimes Vorgehen. Gleichzeitig verlangt dieser Ansatz höchste Sorgfalt und ein hohes Maß an Transparenz für die Auswahl und die Arbeit des SAB.
- GEN-AU wird mit Engagement und Erfolg von einem Team administriert, das im Ministerium angesiedelt und im Zuge des allgemeinen Aufnahmestopps im öffentlichen Dienst über Leiharbeitsverträge an das Programm gebunden ist. Diese Lösung weist insofern Vorteile auf, als dass eine unmittelbare Nähe zwischen der Strategie- und der Umsetzungsebene gegeben ist. Jedoch werden solche Vorteile von jenen Hürden mehr als konterkariert, welche die (auch die moderne) Ministerialbürokratie für die Administration von forschungs- und technologiepolitischen Programmen setzt.

Jene Schritte, die schließlich zum Aufsetzen des GEN-AU Programms führten, kurz gesagt die Designphase, sind mit Engagement vorangetrieben worden: Netzwerktage wurden organisiert, somit das wissenschaftliche Potential eingeschätzt, (auch internationale) Experten/innen zugezogen, und schließlich ein Strategiepapier formuliert. Dies ist bei weitem über dem ‚österreichischen Standard’ des Programmdesigns. Man plante zu diesem Zeitpunkt GEN-AU mit starker Industriebeteiligung und als ‚Public Private Partnership’. Nun wurde jedoch dem Programm im Laufe der ersten Ausschreibung ein neuer Spin gegeben – man rückte vom klaren Anwendungsfokus ab und konzentrierte sich (auch auf Betreiben des wissenschaftlichen Beirats hin) auf die wissenschaftliche Qualität der Projekte – eine Umorientierung, die von ihrer forschungs- und technologiepolitischen Rationalität zwar äußerst begrüßenswert war, von ihrem Zeitpunkt her jedoch denkbar ungünstig. Ungünstig, weil Wissenschaftler/innen, die der Aus-

schreibung wortgetreu folgten, mit einem Mal schlechte Karten für die Projektvergabe hatten; begrüßenswert, weil aus Sicht des Gesamtportfolios der österreichischen Förderszene der Schritt hin zur puren Förderung von Wissenschaft gut und richtig war; es gibt heute ohnehin im österreichischen Portfolio genügend Programme, die science-industry linkages zum Thema haben. Zusätzlich schafft GEN-AU durch die Kooperation mit der aws auch und trotz der Umorientierung ohnehin Bewusstsein für wirtschaftliche Umsetzung und thematisiert immer wieder Verwertungs- und IPR-Aspekte, was zu unterstützen ist.

GEN-AU bedient sich in einigen speziellen Fragen der Administration professioneller Partnerorganisationen: Etwa der aws als Spezialist in Fragen des geistigen Eigentums und der Verwertung und dem Verein dialog<>gentechnik bzw. dem PR-Berater Science Communications in Fragen von Öffentlichkeitsarbeit. Generell ist dieses Zuziehen ein höchst lobliches Vorgehen; nicht jedes Programm muss das Rad neu erfinden. Während die Kooperation mit der aws als erfolgreich und ausbauwürdig anzusehen ist, gab es in der internen (und externen) Kommunikation im Bereich der Öffentlichkeitsarbeit einige Punkte (vor allem die Kompetenzzuschreibung unter den Akteur/innen), die als verbesserungswürdig anzusehen sind – ein Bild, dass sich gerade in der Zufriedenheit der geförderten Forscher/innen widerspiegelt: Die allgemeinen PR-Aktivitäten waren der meistkritisierte Punkt in diesem Analyseschritt, gefolgt von der Mittelvergabe und der Dauer ihrer Ausschüttung. Als besonders positiv wurde dagegen die Unterstützung durch das Programmbüro angesehen, (auch daher) das Urteil des engagierten und erfolgreichen Programmteam weiter oben. Die durch das Programmbüro verursachten Gemeinkosten sind als sehr niedrig anzusehen, vor allem wenn man bedenkt, dass GEN-AU ganz bewusst den Weg eines aktiven Programmmanagements eingeschlagen hat. Dies ist ressourcenintensiv und sollte auch in Zukunft nicht von zu engen Vorgaben durch die (politischen) Stakeholder eingeschränkt werden.

Wesentliches Alleinstellungsmerkmal des Programms ist der Netzwerkgedanke – nicht nur auf Ebene des Programmmanagements, sondern auch, und vor allem, auf Projektebene – Kooperationen verschiedener Forschungseinrichtungen sind gewünscht und verpflichtend. Dieser ‚Zug zum Netzwerk' wird (nicht nur im Rahmen von GEN-AU) des Öfteren kritisiert und hat dort seine Berechtigung, wo diese Form der Forschungsförderung nicht mehr von anderen, ‚klassischeren' Formen, vor allem von Einzelforschungsprojekten, ergänzt wird. Mit anderen Worten: Neben der Verfolgung von Netzwerkprogrammen muss die ‚Grundversorgung' der Forschenden mit Einzelprojekten gewahrt bleiben. Auch wenn der FWF als Träger dieser Einzelprojekte seit Jahren unter weit reichenden Budgetnöten zu leiden hat, ist zumindest von einem ‚Verdrängen' durch GEN-AU nicht auszugehen.

In GEN-AU wird vom „Networking" in einem hohen Maße Gebrauch gemacht, Beziehungsstrukturen scheinen eng zu sein, gleichzeitig ist das Netwerk nicht in sich geschlossen, man ist offen für neue Kooperationen. Austausch und Kommunikation erfolgt nicht nur innerhalb von Projekten, sondern auch über Projektgrenzen hinaus. Relativ isoliert scheinen die Begleitforschungsprojekte (ELSA) zu sein. Man kann generell von einem aktiven Leben des Netzwerkgedankens in GEN-AU ausgehen; es wäre allerdings zu weit gegriffen, aus diesem Befund heraus einen kausalen Zusammenhang zum Programm zu konstruieren.

Neben der eigentlichen Arbeit in Forschungsprojekten verfolgt GEN-AU einige weitere Aktivitätslinien, die hervorgehoben werden sollten: Summer Schools für Schüler/innen, denen die Möglichkeit geboten wird, in den Forschungseinrichtungen (im wesentlichen im Labor) mitzuarbeiten, und ein eigenes Mobilitätsprogramm, das jungen wissenschaftlichen Mitarbeiter/innen Forschungsarbeit an internationalen Einrichtungen für eine bestimmte Zeit, eng mit dem eigentlichen Projekt verbunden, ermöglicht. Beide Aktivitäten sind als Erfolg zu bezeichnen und sollen beibehalten und ausgebaut werden.

Das, was man im Englischen gerne den ‚crucial point' nennt, ist im Rahmen von GEN-AU mit Sicherheit die Projektauswahl und -evaluierung. Rund um diesen Prozess waren Gerüchte und versteckte Andeutungen wahrzunehmen, die als sehr schädlich für Reputation und Erfolg des Programms einzuschätzen sind und die dringend an ihrer Wurzel bekämpft werden müssen. Gemein ist all den Vorschlägen zu dieser Bekämpfung der Ruf nach mehr Transparenz: Man

möge den neuen Spin, den man dem Programm durch Ausrichtung auf wissenschaftliche Qualität gegeben hat, nun nicht mehr verlassen und sehr klar transportieren. Man möge weiters von Beginn an klar definieren, welche Projekttypen zu welchem Zeitpunkt Gegenstand der Ausschreibung sind, man möge Projekte ausschließlich in breiten, öffentlichen und wettbewerblichen Verfahren vergeben, und schließlich, man möge eine klare Trennlinie zwischen den Förderempfänger/innen und jenen ziehen, die über die Vergabe entscheiden. Auf die besondere Sorgfalt, die die Bestellung und die Zusammensetzung des Scientific Adivsory Boards verlangt, wurde schon hingewiesen. Es sind dabei zwei Punkte zu betonen: Bis jetzt ist es gelungen, Wissenschaftler/innen mit hoher und höchster Reputation als Mitglieder des Scientific Advisory Boards zu gewinnen; gleichzeitig wird die Motivation solcher Persönlichkeiten zur Teilnahme immer schwierig sein und ein schwieriges Abwägen bzw. einen trade-off darstellen: einerseits ihre Kompetenz und Erfahrung („good people are always involved“), auf der anderen Seite ihre Unabhängigkeit („Lily white people do not understand the system“). Die Kleinheit des Landes darf aber nicht immer Entschuldigung dafür sein, dass in diesem trade-off das Pendel des Abwägens in eine bestimmte Richtung ausschlägt.

Aufgabe des Evaluierungsteams war es, im Wesentlichen zwei Fragenkomplexe zu beantworten: „Soll das Programm fortgesetzt werden?“ und „Welche Verbesserungsmöglichkeiten sind zu identifizieren?“

Mit diesem Evaluierungsbericht geben wir ein klares Bekenntnis zur Fortsetzung des Programms ab. Wir haben in der sozialen Netzwerkanalyse und in über 70 Interviews Forscher/innen gesehen, die kooperieren und konkurrieren, die miteinander im Austausch stehen, die publizieren und patentieren: kurz, wir haben ein lebendiges Forschungsumfeld im Rahmen von GEN-AU kennen gelernt. GEN-AU verfügt über eine klare forschungs- und technologiepolitische Legitimation und spielt eine bedeutende Rolle für die Forschenden im Bereich der Life Sciences. Mit seiner (im Vergleich) langfristigen Orientierung und dem hohen Budgetvolumen trägt es zu jener Kontinuität bei, die von Forschenden oftmals eingefordert wird.

Gleichzeitig sehen wir viele kleine und einige bedeutende Ansatzpunkte für Verbesserungsmöglichkeiten:

- Den wichtigsten Ansatzpunkt, ein „Mehr“ an Transparenz im Vergabe- und Evaluierungsverfahren, möchten wir nochmals mit Nachdruck unterstreichen.
- GEN-AU sollte hinkünftig – unter Wahrung der bisher aufgebauten Kompetenzen im Managementteam – von einer Agentur umgesetzt werden. Diese Agentur sollte genügende Erfahrung im Bereich der Förderung von Grundlagenforschung mitbringen.
- Im Zuge dieser Agenturifizierung sollten auch einige Abläufe, wie etwa die Projektabrechnung, modifiziert und flexibilisiert werden.
- GEN-AU ist ein wichtiges Instrument in der Förderung von Forschung, jedoch nicht das einzige. Programme wie dieses sollten klassische Instrumente der Forschungsförderung (v.a. Einzelprojektförderung) ergänzen, nicht ersetzen.
- Die Kommunikations- und Governance Strukturen zwischen den Programmpartnern sind, insbesondere im Bereich der Öffentlichkeitsarbeit, verbesserungswürdig: Klare Hierarchien, klare Verantwortlichkeiten und Prozeduren sind zu empfehlen.
- Es sollte zu einer Verlängerung der Fristen im Rahmen der Calls kommen, des Weiteren sollten Road Maps alle wesentlichen Termine zusammenfassen und mittel- bis langfristiges Planen ermöglichen.
- Die Abstände zwischen Projektevaluierungen sollten gestreckt werden, gleichzeitig sollte die bisherige jährliche Evaluierungskonferenz zumindest als Netzwerktag beibehalten werden.
- Die vorgeschriebene Verwendung des Corporate Designs sollte dahingehend modifiziert werden, dass zumindest Nuancen zwischen den einzelnen Projekttypen erlaubt sind.

- Die Nutzung der englischen Sprache in Dokumenten und für die Homepage könnte intensiviert werden, auch um den internationalen Charakter zu erhöhen.
- Die für die PR verwendeten Kommunikationskanäle sollten zielgruppenspezifisch intensiver genutzt werden. Dies gilt für die Newsletter (deren Funktionalität überprüft werden sollte) oder auch für eine zu erstellenden Homepageabschnitt, der speziell für Schüler/innen designed werden sollte.
- Man möge eine Verkürzung der verpflichtenden Dauer des Mobilitätsprogramms in Erwägung ziehen.
- Geeignete Schritte für eine spätere Impact-Analyse des Programms sollten schon jetzt eingeleitet werden.
- Anstrengungen sollten unternommen werden, ELSA Projekte besser in GEN-AU einzubinden; etwa durch die Einbeziehung dieser Projekte in zukünftige GEN-AU Veranstaltungen.
- Schließlich sollten die Vertragsverhandlungen zwar weiterhin flexibel, aber entlang klarer Regeln gestaltet werden.

Executive Summary

In 2001 the Austrian Federal Ministry for Education, Science and Culture, bm:bwk, launched the 'Austrian Genome Research Programme GEN-AU' (**GEN**ome Research in **AU**stria). The genome research programme was planned for a period of nine years. It receives funding every three years (consequently, the running time of GEN-AU is made up of three different phases), and approximately € 10.7 million are spent on GEN-AU each year. The mission is to strengthen genome research in Austria and to foster networking among all relevant stakeholders and actors. In order to achieve this goal a variety of project types were developed: Large cooperative projects, network projects, pilot projects and projects addressing accompanying research in the social sciences. The project types differ in terms of the number of involved partners, their running time and their funding volume. In phase I of GEN-AU € 27.8 million have been allocated to 23 projects run by 91 partner organisations. The majority of the funded institutions are located in Vienna, but a number of scientists in Graz, Innsbruck and Linz received financial support, too.

There are several reasons why GEN-AU can be considered a special, if not unique programme within the Austrian research and technology policy landscape:

- Besides its main goal, which can be described as the promotion of high quality research, it also stipulates a number of other objectives. For some of these secondary goals special measures have been put in place (most notably, for supporting young researchers (by organizing Summer Schools for high school students) and in the filed of public relations (in order to improve public opinion on genome research)).

- Even if, according to many scientists, there can never be enough funding for research, one has to keep in mind that GEN-AU, with its yearly € 10 million budget, is the largest thematic programme in Austria. After all, GEN-AU's budget amounts to 10 % of the total budget of the Austrian Science Fund (FWF).

- GEN-AU is the only thematic top-down programme in Austria where the top-down approach is taken to the very limit. As an example, GEN-AU does not stop at defining subjects and corresponding project types. The scientific advisory board (SAB), which decides whether an applicant receives funding or not, reserves the right to take appropriate action and change the set up of the projects and the composition of the research teams. By doing so, the SAB actively shapes the programme in large parts according to its own agenda (and, more generally, also genome research in Austria). Consequently, the SAB is more of a "steering committee" than a "jury" in the usual sense. This is (at least for Austria) on this scale new, it is risky, but, nevertheless, legitimate. At the same time, however, this approach calls for uttermost prudence and for a high degree of transparency with regard to the selection of the board members and the work of the SAB.

- GEN-AU is administered and managed by a highly committed team situated in the ministry. As – due to budgetary constraints – the ministry is not allowed to hire new personnel, the GEN-AU employees have signed temporary employment contracts with another institution which is in turn put in charge of GEN-AU operations. This solution has insofar advantages as it guarantees spatial proximity between the strategic and the operating level. However, this reward is more than compensated by barriers which arise from the ministerial bureaucracy and its rules concerning the administration of research and technology programmes.

A lot of effort was put into the design of GEN-AU: Network days were organised, possibilities to tap the full scientific potential were assessed, national as well as international experts were consulted and, eventually, a strategy paper was drafted. This is by far above the "Austrian standard" of programme design. At that time GEN-AU was to be a programme with strong industry links, organised as a "public private partnership". With the first call the

programme received, however, a different spin. The focus shifted (in accordance with recommendations from the Scientific Advisory Board) from a rather applied undertaking to a programme which places more emphasis on scientific quality. This reorientation had positive and negative effects. On the positive side, the move towards basic research was well justified as there are enough programmes in Austria that pick science-industry linkages out as a central theme. In addition, GEN-AU, by means of collaborating with aws, provides measures that deal with commercialisation of research results and IPR. This collaboration is certainly an asset to the programme. On the negative side, the timing of the shift was less than optimal as those scientists who followed the call specifications closely found themselves suddenly in a rather unfavourable position for receiving the funds they applied for.

GEN-AU reverts to professional partner organisations for special administrative issues: aws, for all issues related to intellectual property rights and the commercialisation of research results; dialog<>gentechnik and science communications (an association and a consultant for PR, respectively) for all matters associated with public relations. The evaluation team believes that, generally speaking, outsourcing certain issues to specialists is a viable thing to do. Not every programme needs to reinvent the wheel a second time. But while the cooperation with aws seems to work well (and should be expanded), internal (and also external) communication in the area of public relations was sometimes flawed. Most notably, division of labour and the different areas of responsibility among the involved institutions were on some occasions not clear enough to outsiders (including the scientists in GEN-AU as “customers”). This is also reflected by low satisfaction levels with public relation activities in GEN-AU: Of all aspects the scientists involved in GEN-AU had to rate in the course of an online survey, this aspect received – on average – the lowest grade. Relatively low grades were also given to the “allocation of funds” and to the “time from start of the project to receipt of money”, which ranked second and third, respectively, after “PR activities in general”. On the other end of the scale, the scientists were particularly satisfied with the support given by the GEN-AU Programme Office, which is also a reason for the positive verdict given earlier. The overheads resulting from operating the GEN-AU Programme Office are very low, given the fact that an active programme management is pursued. Active programme management utilizes a lot of resources and should not, also in the future, be constrained by too tight requirements of the (political) stakeholders.

An important aspect that sets the programme aside from other initiatives is its dedication to the idea of networking. In the context of GEN-AU, active networks should not only be established at the management level but also, and most importantly, at the project level. Collaboration between different research institutions is welcome and compulsory. This trend towards networks has met (not only with respect to GEN-AU) considerable criticism out of the fear that it might replace more traditional forms of support, most notably support given for individual projects. It is clear that a certain level of support for individual research undertakings must be maintained, regardless of whether network programmes are implemented or not. Yet even when considering the far reaching budgetary constraints of the FWF (the main institution providing funding for individual projects in Austria) there seems to be no evidence to indicate a “crowding-out” effect, i. e. that GEN-AU takes away resources from the FWF.

Networking takes place to a high extent in GEN-AU. The scrutinized communication and exchange networks are very dense and exhibit high levels of activity. Lock-in effects seem to be avoided. Exchange and communication does not only take place within projects but also extend beyond project boundaries. It seems, however, that the accompanying research projects in the social sciences (ELSA) are rather isolated. Furthermore, the extent, to which the GEN-AU programme has contributed to the networking, is still a rather open question. Many network relations have already existed prior to the implementation of the support programme.

Besides its main thrust, the research projects, GEN-AU exhibits also other lines of activity that are worth mentioning: Summer Schools for high school students (which (mainly) give the students the possibility to work in laboratories) and a mobility scheme. The latter allows young researchers to work for a GEN-AU project for a certain amount of time at institutions abroad. Both activities can be considered as a success and should be maintained and expanded.

Proposal review and project selection processes are certainly a crucial point for GEN-AU. Rumours were afloat with respect to these processes, a fact that must be regarded as very harmful for the reputation and the success of the project. It is imperative that these rumours be tackled at their roots. All suggestions in this context point to measures that increase transparency: One should stick to the new spin of the programme (that is its (shifted) focus on scientific quality) and convey this new strategy very clearly. Furthermore, one should communicate visibly what types of projects are put out to tender at a given time. It should be taken care that projects are solely selected based on broad, public and competitive procedures. Eventually, it was suggested to draw a clear line between those who receive funding and those who decide on allocating the money. It has already been underlined that care has to be taken when selecting members for the SAB. Two things must be kept in mind in this respect: Up until now, GEN-AU was able to attract renowned scientists for the SAB. On the other hand, it is always difficult to get such personalities to do this kind of job as there will constantly be a trade-off between their competence and experience ("Good people are always involved.") and their independence ("Lily white people do not understand the system"). The small size of the country should, however, not always serve as an excuse that the pendulum between the different poles of the trade off predominantly swings to one side.

The evaluation team was asked, in essence, to answer two overarching questions: "*Should the programme be continued?"* and *"Is there room for improvement?"*

With this evaluation report we clearly advocate the continuation of the programme. Having used a social network analysis and having conducted more than 70 interviews we have encountered a lively environment within the framework of GEN-AU with researchers who compete, collaborate, exchange information and resources, patent and publish. GEN-AU is undoubtedly, research policy and technology policy wise, legitimate and plays an important role for researchers in the life sciences. With its (relatively) long term orientation and with the high total funding volume in mind, GEN-AU contributes to the kind of continuity researchers often call for.

At the same time, we see a lot of small (but also a few significant) starting points for improvements:

- The most important point (which we want once again to underline) is to ensure more transparency in the proposal review and project selection procedures.

- GEN-AU should be run by a specialised agency. However, the know-how that has been built up till now should be retained. The contracted agency should have experience with the promotion of basic research.

- In the course of the agencification process some procedures, such as project settlement procedures, should be modified and designed to work in a more flexible manner.

- GEN-AU is an important instrument, but not the only one for promoting science. Programmes like GEN-AU should complement classic support measures (especially grants given for individual projects), not replace them.

- There is room for improvement with respect to the communication structures between the programme partners, especially in the field of public relations. We recommend establishing clear hierarchies, clear responsibilities and clear procedures.

- Allow for better time planning by issuing a road map with all relevant deadlines. Deadlines with respect to calls should be extended.

- The time span between individual project evaluations should be increased. At the same time it could prove beneficial to retain the annual conference and use it for networking and for exchanging information.

- With respect to corporate design we would suggest to modify its usage in order to allow for nuances among the different project types.

- We also suggest using the English language more frequently in documents and for the homepage in order to increase the international character of the programme.

- Public relations activities should make use of information channels that are tailored more to the intended target groups. This applies, in particular, to the newsletter (the functionality of which should be checked, too) and those still to be developed sections of the homepage that are dedicated to high school students.

- One might also consider shortening the compulsory term of the mobility scheme.

- Appropriate steps should be already taken now for a later impact analysis.

- Considerable efforts should be put into integrating ELSA more with the whole framework of GEN-AU (e.g., by incorporating ELSA projects more in future GEN-AU events).

- Eventually, contract negotiations should be handled in a flexible manner (as they were already), but should nonetheless be subjected to and follow clearer rules.

GEN-AU: Conclusions, Options & Recommendations

The ministry and the GEN-AU office asked the evaluation team 17 evaluation questions; these questions guided the design of our efforts and are answered and augmented in the previous chapters. To conclude this evaluation, we briefly summarize the answers to these questions. In addition, we summarize policy as well as management options and recommendations in this chapter.

The over arching questions are

- *Should the Programme in its present form be continued?*

  A: Yes. There is a clear legitimacy for programmes like GEN-AU. GEN-AU plays an important role in the Austrian funding scene for basic research in the life sciences. Carrying on the programme is an important signal for the community and ensures continuity of funding for a designated period and strengthens the environment with regard to research promotion and networking.

- Is there room for improvement?

  A: Yes, definitely. We strongly recommend that steps be taken to ensure more transparency in proposal review, project selection, and contract negotiation processes. We recommend that outreach to the genome research community be carried out in a fair and equitable manner whereby all receive similar information about calls in the same time frame. We strongly recommend that the funding instruments be used and the criteria to judge proposals be established up-front and be adhered to rigorously throughout the procedure. We strongly recommend that GEN-AU be relocated within an agency. Moreover, we have identified several other possibilities to make GEN-AU better (see chapter 10.1).

The more specific questions are:

1. *Is it possible to achieve the strategic goals that were set out with the currently used measures?*

Together with the programme stakeholders, we have identified a whole set of strategic goals within GEN-AU. We think that, due to its lifetime and its comparatively high budget, GEN-AU will play a valuable role in strengthening and networking genome research in Austria: The programme clearly promotes science. Concerning other strategic goals, we are rather sceptical and recommend a degree of caution with regard to expectations: Yes, to a certain extent GEN-AU will promote young scientists; yes, maybe GEN-AU will contribute to promoting women in leading positions; and yes, some of the projects will lead to patents that will be licensed to companies (or may even form the basis for start-ups). But the extent of economic and societal benefits that will be realized in terms of job creation, disease cures, and environmental improvements in the near-term are likely to be limited. Therefore, we recommend the programme to establish a clear hierarchy in the GEN-AU goals and to condition expectations for the different goals.

2. *How is the GEN-AU programme positioned in the Austrian Research environment?*

GEN-AU is the only real top-down programme in Austria. In case of GEN-AU not only are projects selected in response to calls. More precisely: the SAB gives a clear direction for development of genome research in Austria. This is new (at least for Austria), it is risky, but it is legitimate as well. GEN-AU does not duplicate any existing programme, but the programme management should pay some attention to the ‘Sonderforschungsbereiche’ (SFB) of the Austrian Science Fund FWF and find a clearing mechanism. Politicians should keep in mind that a network programme like GEN-AU is only one instrument in a broad spectrum of research

funding; GEN-AU does not replace classical project funding. Therefore, the existence of GEN-AU should not be an argument for 'starving out' other types of funding.

3. *Does the Programme identify sufficient measures with respect to the promotion of next generation scientists training?*

Within the Austrian Genome Research Programme GEN-AU, two measures to promote scientific next generation can be identified. The **"**Mobility Programme**"** aims at young researchers which are involved in a GEN-AU-project and the **"**Summer School**"** is conceptualized for pupils. The Summer School activity should be continued almost unchanged and expanded. These measures are generally very good instruments that need only little adjustment. The programme management and the organising partner institution should make sure that the chosen Summer School pupils meet a certain educational standard needed for their internship. In case of the Mobility Programme a preferable option would be a more flexible designed timeframe of 3 months for the minimum stay for participants of all project types.

Another option to support young researchers, which would complete existing measures, but should have nonetheless an expiry date, would be the creation of "independent grants" which could be associated with GEN-AU. By means of these grants a long term prospect shall be offered. Rationale: A PhD thesis can rarely be completed within two to three years. In case of Post-Doc students there should be the opportunity for these students to establish research groups on their own and thus allow for reputation to be built up. The programme management should check whether or not such an instrument duplicates already existing ones and whether there is a possibility for ties.

4. *What "hot topics" in connection with Genome Research and System Biology support the latest developments in science? Do research-relevant topics or expressions of interest exist concerning this matter?*

Senior experts in genomic research in the U.S. who were interviewed as part of this study identified "hot topics" and trends in Genome Research and System Biology that they saw increasing in importance in coming years. These included the following:

Further integration of biology and bioinformatics to make better use of data. The marriage of biology, advanced computer science, engineering, physics, and advanced mathematics - but particularly biology and computer science - is seen as a trend critical for future advances in genomic research. Harnessing advanced computing power to biology is important because high throughput genomics and proteomics are generating huge amounts of data. There are big research opportunities in mining the vast amounts of data to find hidden information. A traditionally trained biologist can find the obvious things by looking at the data, but a biologist/bioinformaticist who knows how to harness advanced computing power can efficiently find more subtle things that may hold the key to further advance.

Study of human variation and how variation is related to disease and how it affects individual response to medicine. This entails understanding human variation in the context of suites of gene variability – putting together understanding of whole pathway processes -- in order to develop **personalized medicines** and, over time, change medicine from reactive, to predictive, to preventive. It is important to characterize the variation of biomarkers of many humans in order to approach this goal.

High-throughput analysis of proteins. The USA is scaling up for large scale sequencing of proteins and is expected soon to move from the pilot stage into full production. Vast amounts of data will emerge from this effort in the future. This will provide a critically important downstream opportunity for mining and interpreting the resulting data, converting it from data to knowledge.

Sequencing and comparisons of genomes of different organisms, including the whole spectrum of organisms will increase understanding of how biological mechanisms operate and

the nature of their constraints. (The U.S. Department of Energy is particularly focused on sequencing microbial genes.)

Exploitation of nano-biotechnology to develop new materials is seen as another hot topic.

Development of biological approaches to improve the environment, including biological approaches to carbon sequestration, reducing emissions, and waste remediation is seen as offering increasing opportunities in the future to help solve global warming.

Development of bioenergy sources is a promising way to meet the world's energy needs.

5. *What future or retrospective data should be collected for a planned impact-analysis?*

As set forth in more detail in section 9, data should be collected routinely, systematically, and retrospectively by programme staff for programme activities, outputs, and outcomes. The data identified in Section 9 can be presented as indicators of progress towards intended impacts and some of it can later be used in conjunction with an impact analysis. For impact analysis, the indicator data should be supplemented by contractor collected case-study data, co-publication and sociometric data from network studies, patent citation data, survey data and industry data collected by interview and from existing association and industry databases. (See Section 9 for the listing of potential measures, identification of associated data, and outline of a data collection plan.)

6. *Are present methods for the evaluation and selection of research projects "state of the art" or in need of change?*

There are some elements in the selection and evaluation processes that are definitely state of the art: two-step procedures and international peer review. At the same time, some aspects of project selection cannot be characterized as international state of the art. We have discussed in some detail the lack of transparency within GEN-AU and the problems that can arise due to that fact. We have also discussed the problem of a 'double role' of members in the SAB.

7. *Are the procedures and guidelines for the annual report on interim evaluations appropriate?*

During our interviews, we heard no complaints about reporting except that guidelines are not provided at the beginning of a reporting period, but towards its end. Therefore, we argue that the procedures and the content of guidelines were more or less appropriate. However, guidelines need to be provided at the beginning of a reporting period.

8. *Was the contract negotiation and design procedure adequate?*

We accept the necessity of sufficient degrees of freedom when starting contract negotiations with beneficiaries. We accept, for example, that IPR issues make negotiations more complex, particularly when companies are involved. A certain amount of flexibility is clearly an asset of modern programme management. However, there should be some 'guidelines' or, let's call it 'standards', to define what is possible during the negotiation phases, and what is not possible; for example, those who are doing the contract negotiations must not overrule the decisions or requirements of the Scientific Advisory Board (provided that the board follows the established procedures, for example, in allocating funds); they have to insist on the pillars of the project proposal: the maximum budget and the person who is the project leader. We think that there is room for improvement for the negotiation processes.

9. *Are the allocation of human resources, financial resources and administrative expenses of the GEN-AU office in proportion to the agendas?*

The overheads resulting from the operation of the GEN-AU Programme Office amount to approximately 6.4 % of total funding volume, if costs for public relations are taken into account, or 2.3 %, if PR costs are not included. We believe that these figures are very low (and thus more than appropriate, also on an international level), given the fact that an active programme management is in charge of GEN-AU operations. As regards human resources, all data available to us indicates that the office does a very good job and that the staff employed is highly committed. Considering the work load it might be a good idea, however, to periodically check whether an additional employee is needed.

10. *Is the network of partners functioning so that sufficient communication is taking place? Is resource allocation adequate?*

The results of the SNA lead to the image of a complex pattern of intensive communication relationships between the cast of actors involved in the GEN-AU-Projects. At the same time one gets the impression of a complex functional net that involves a remarkable high degree of project- and cluster-spanning cooperation; research related resources (material and personnel) and information that are relevant for the functioning of the GEN-AU programme are being exchanged between the GEN-AU projects, especially around the cooperative and network projects.

11. *What possibilities or methods, also on an international level, exist, to help increase the percentage of female executives within research networks of the scientific sector?*

We have shown what possibilities, in principle, exist to help to increase the percentage of female executives within the scientific world. Considering the Austrian circumstances and the great variety of different promotion schemes in this field that suffer from budget constraints, we recommend to try to identify cooperation possibilities with existing initiatives, but also to think about a new prize and dedicated smaller projects to be run autonomously by women.

12. *With regard to future tender specifications, is it advisable to lay down solely the technical requirements for the content of the proposals or should structural guidelines/requirements also be included in the tender documents?*

We recommend lying down all requirements for the different calls when the call is issued, not later.

13. *Are the tools offered within the programme (Cooperative projects, pilot projects, and networks) the best for the achievement of objectives?*

All the tools that are offered within GEN-AU are (only) a selection of possibilities for programme designers. Of course, also ‘pure’ basic research projects can strengthen genome research in Austria; of course, mobility grants of the Austrian Science Fund promote young researches. So, there are a lot of different ways to get to Tipperary and it is hard to say whether those chosen by GEN-AU are the best, but at least they do not appear to be inappropriate. We suggest sticking to the tools that are in place now, with the exception of associated projects, which should be abandoned. Only scheduled calls should be used to allocate money.

14. *What other nationally or internationally applied tools to network academia with the economy can be additionally suggested to those already offered?*

We want to suggest intensifying links with existing instruments, e.g., aws (LISA), FFG, FWF (more), and also to explore new ways for commercialisation of research findings other than patenting and licensing, for example, for areas like bioinformatics. Cases in point would be license models that are used in the software sector (e.g., open source, etc.)

15. *Does the programme exhibit sufficient action in the area of public relations or public awareness?*

GEN-AU is the first research support programme in Austria to feature dedicated public relations activities. This and the fact that a network of professionals for PR work has been placed in charge of these tasks are to be regarded as positive. The action taken by these partnering institutions should in principle cover all necessary actions related to PR but have failed to produce, up to now, the desired results. Among other things, adjustments have to be made regarding the coordination between the partners in the partner network (clear hierarchies and work distribution), the functionality of the newsletter has to be checked and the English homepage should be updated more frequently. The Summer School can be considered a success story and should be expanded and more actively communicated to the media.

16. *Is there an adequate networking of policy in the areas of science, research, and education within the framework of GEN-AU?*

The results of SNA on one hand reflect the top down design of the programme, and on the other hand indicate that operative programme management performs well. Of all management units it is the Programme Office that is particularly involved in the communication relationships. This reflects the interface and coordination function of the Programme Office.

The links to education are primarily given by two aspects: a) involvement of university institutes and b) – more explicitly – by the presence of the Summer Schools. The Summer Schools are highly valued and important for attracting future researchers. Networking for educational purposes works reasonably well. Although some high schools may (supposedly) not be aware of the GEN-AU Summer School, the number of students applying by far exceeds available capacity.

The results of the SNA show that the relationships between the core actors of the network are to a large extent multiplex. This high degree of multiplexity indicates stable and trusted relationships between the involved actors. Furthermore, GEN-AU is an open net. Ideas and knowledge of relevant innovations in the field of international genome research can diffuse beyond the boarders of the GEN-AU network. There are no indications of lock-in effects that are problematic for research processes. So far, it has to be said that the GEN-AU exhibits all features that are inherent to functioning innovation networks.

17. *Where on an international level does the collateral research programme ELSA stand?*

Austria with its GEN-AU ELSA programme is one of the countries which carry out special programmes for ethical, legal and social aspects of genome research, but do not have institutionalized ELSA centres. ELSA research is common practice (“part of the mission”) in the international context and there is something like a requirement to involve natural scientists in social science projects. However, many natural scientists view ELSA research primarily as a marketing tool (or, put differently, would like to see ELSA research used for this purpose) for promoting their work to the general public – which is clearly not the goal of ELSA. This conflict of interests between natural and social scientists might pose a problem. Social scientists plead for intensified networking with the natural sciences and attach particular importance to communication platforms such as conferences, symposiums and other events. ELSA research should be funded but not too strictly shaped by policy makers. Taking into account these parameters and the fact that ELSA activities just started in 2004 the Austrian ELSA programme is positioned very well in the international context.

34 Options and Recommendations

The following points are options and recommendations we would like to suggest as a consequence of the evaluation results:

1. **Ensure more transparency in the proposal review and project selection procedures**. GEN-AU suffers from many rumours and innuendoes in the science community concerning 'double roles,' the unexpected creation of project types and associated projects without clear explanation, and the inclusion in projects of entities who did not propose in response to a call. We strongly recommend that the ministry not pass over this problem in silence, but that it put a lot of emphasis on ensuring more transparency within GEN-AU: exclude the possibility of double roles (e.g., avoid having a beneficiary who is also a member of the scientific advisory board), do not fund new instruments and 'associated projects' outside the bounds of normal calls, set strict limits on top-down reshaping of proposed projects, resist bringing into approved projects new participants who have not proposed proposals, make the same information available to all, develop a schedule that allows medium term planning and allows enough time for the preparation of short proposals, adhere consistently throughout the process to announced procedures and criteria, and communicate clearly the evaluation processes and the decisions to the scientific community.

2. **Stop the in-house solution for administrating GEN-AU.** GEN-AU should be run by a specialised agency. Due to the basic research character of the programme, the contracted agency should have experience with the promotion of this type of research. In any case, the recommendation is that GEN-AU not be integrated into the day-to-day business scheme of an agency. GEN-AU has developed certain expertise and instruments that are highly regarded and are the 'unique selling point' of the programme. Knowledge, competences, and skills that were built up in the last years must not be lost. Finally, feed-back loops with the ministry should guarantee a close relationship to the strategic decision makers of the programme.
3. **Scientific Advisory Board SAB:** Take care that the SAB does not change the rules of the game after the game has started. **Guarantee international composition of the SAB**.
4. **Do not invent new project types when evaluating proposals.**
5. **Find a workable trade off regarding the composition of the SAB** that is positioned between the two prevailing extreme views, i.e., that. "Good people are always very involved." versus "Lily white people do not understand the system."
6. As the topics of projects in phase II of GEN-AU cannot be predicted, gaps in the expertise of the Scientific Advisory Board may also occur in the future. In order to assure optimal guidance and support for the projects it may be necessary to **extend the advisory board according to the actual project portfolio**.
7. **GEN-AU is an important instrument, but not the only one for promoting science** (in the field of genome research). Other such instruments, e.g., classical project funding, which nowadays severely suffers under strict budget constraints, are extremely important for scientists and play a vital role in the Austrian research policy system. Policy must not replace budgets that are usually earmarked for such classical instruments with new targeted instruments. The GEN-AU budget should clearly be fresh money.
8. It should be communicated most clearly that the **character of GEN-AU is basic research** with certain aspects of technology transfer. GEN-AU is first and foremost basic science orientated. The message could be like this: "First we go for quality in research, and then we are interested in commercialisation".
9. During the design activities of GEN-AU, the relevant persons positioned the programme as a Public Private Partnership. The activities in that direction (for example, establishing an industry platform) failed, and also the industry participation was rather loose. So we suggest **skipping the term PPP and sticking to GEN-AU as a programme focused on research quality**.

10. **Improve the communication structures between the programme partners:** establish clear hierarchies, clear procedures and responsibilities. A goal should be to clarify responsibilities among programme partners and foster helpful collaborations. In addition, it should be clearly communicated to the project participants which institution and person is the right contact person for each GEN-AU activity.
11. **Use more formal channels of information** about the programme than informal contacts at the ministry level.
12. **Communicate the broad definition of genome research more clearly.** Some **researchers** would not have considered themselves as eligible for application because of their research topics.
13. **Allow better time planning:** Issue a GEN-AU 'roadmap' with all relevant deadlines to allow for mid-term or even long-term planning and stick to the roadmap. Payment dates, tender dates and evaluation dates should be announced fairly long term.
14. **Define ELSA projects as an integrated part of GEN-AU**. Don't give the picture of a programme standing apart from other project types in GEN-AU.
15. **Try to increase communication between ELSA projects, but also between ELSA projects and other projects.** This could be achieved via a joint annual networking meeting of all GEN-AU projects with sufficient time allowed for all projects to be presented. However, in addition, a special meeting for ELSA researchers may be needed to promote interactions. Smaller topic-specific meetings may in general be a good possibility to supplement the networking efforts.
16. **Consider using the annual conference for networking and information exchange rather than the project evaluation,** and schedule the project evaluation of both ELSA and other projects on a mid-term or bi-annual basis, followed by a more in-depth impact assessment a few years after project end.
17. Allow **more flexibility in cost planning**. Do not expect that projects can make a detailed cost planning (e.g., per month) for the whole period of time.
18. **Corporate Design**: We understand that the GEN-AU corporate design is important to the ministry and the programme management, but we **would suggest nuances among the different project types.** It is clear that in projects with a quite high budget (e.g., networks) the guidelines must be detailed and applied strictly, but one should lighten the rules for smaller projects, like ELSA.
19. **Check the functionality of the GEN-AU newsletter**. There were several complaints that newsletters only arrive sporadically and that the sign-in process has to be repeated in order to assure staying on the mailing list.
20. **Redesign the homepage in a way to include a special section for high school students with a more upbeat design**.
21. **Provide more material in English**. This applies to a variety of documents, such as the webpage (which should be updated more frequently), evaluation reports, etc.
22. **Explore new ways for commercialisation of research findings other than patenting and licensing**. Cases in point would be license models that are used in the software sector (e.g., Open Source, etc.)
23. **Provide more detailed feedback on project evaluation reports**. This issue was raised by many interviewees indicating a weakness in this respect at the programme management level. In addition, one could also think about fostering informal communication channels with the SAB at the evaluation conferences.

24. GEN-AU is an ambitious programme with a whole set of goals that demands a highly committed management team, but also dedicated programme partners. Considering these circumstances, we think that the overheads for the GEN-AU programme are extremely low. We do not think that extremely low levels of overheads should be a goal for actively managed programmes like this; **policy should accept that programmes addressing a large variety of goals like GEN-AU face more costs than initiatives focusing on a small number of goals and having a higher level of routine tasks**, e.g. the research projects managed by FWF.

During our interviews, different issues were raised, things were criticised and suggestions were made concerning how to make GEN-AU better. The following section is based on those inputs.

25. ***Was GEN-AU (too) late****?* A lot of interviewees were convinced that research in the field of genomics is important; the role of GEN-AU in this context was summarized as crucial. Nevertheless, a relevant number of interviewees stressed the fact that this thematic priority was set too late (5 – 10 years late).
26. *Policy makers should put more effort into* ***finding proper and timely ways to do priority*** **setting**. This should not be done separately or for structural policies (e.g., for Life Sciences, for each programme or for each department in the relevant ministries), this should be a joint effort of all relevant policy makers in order to set-up a national strategy.

27. ***There is not much interest in ELSA research per se,*** despite the seemingly contradictory fact that many natural scientists regard ELSA research as generally important. To initiate and foster the relationships between social and natural scientists one could consider the organisation of conferences and symposiums focussing on the (information) exchange on a scientific level.
28. ***Improve information flow:*** Nearly all people we talked to (people in projects, losers, and programme partners) received information on GEN-AU either directly from the ministry or indirectly via personal contacts with those who were informed directly or served on the editorial board of the GEN-AU strategy. Only a very small number of people received information via formal contacts. This can be considered as a barrier for researchers who are not part of informal networks. Particularly young scientists, but also women, may not receive the necessary information in time.
29. The programme management should use **other information policies** in addition to personal contacts: road shows, posters, newsletters from other organizations (e.g., FFG, FWF, aws), a better use of the email contacts to a standardized and broad list, such as attendees of major conferences in biology, websites, etc. Also information brokers could be informed in a strategic way to pass on information.

30. ***Thematic orientation:*** We learned in several interviews that it was not clear from the beginning that GEN-AU has an open thematic orientation: That is, some of those who do research on plants' genomes were convinced (even before GEN-AU was launched) that the programme would focus on the human genome; some of those researchers were convinced that there is a bias against their research when taking the fields of expertise of the SAB into consideration. We found no evidence to support these rumours.

    The programme management should give clear signals to all groups of researchers working in the field that the competition in GEN-AU is open and that all groups following the GEN-AU rules and scoring high against published selection criteria have equivalent chances.

31. ***Contract Negotiations:*** The efforts that had to be put into contract negotiations varied. In general it can be stated that the model contracts are considered to have been created for research institutions rather than companies. Therefore, companies invested a lot of work and time in customizing the contracts. Especially the IPR issues were debated at length. Besides, ELSA researchers mentioned that the funding contract has not been adapted to ELSA projects. At the time when the contracts were signed the universities started to implement UG02 which caused additional complexity in the contract negotiations, and also accounting issues. According to the GEN-AU office and the background documents, applicants have to agree to the essential points contained in the model contracts when submitting a proposal in phase II of GEN-AU.
    a. We recommend that the programme management make use of the experiences from the contract negotiations during phase I of the programme when starting the negotiations for phase II.
    b. Model contracts should be streamlined.
    c. In addition, it may be worth thinking about designing model contracts that vary with the requirements of the different project types and participations. For example, ELSA projects require different contracts than non-ELSA projects (e.g., without IPR regulations) and projects involving companies need contracts other than those needed by research institutions only.

32. ***Mobility Programme – shorter period of time?*** The mobility programme is considered as an important supplement to the GEN-AU instruments. Nevertheless, the minimal period of time to be spent abroad was criticized. This period was regarded as in excess of the time needed to learn a technique abroad.

    The programme management should consider the pros and cons of generally reducing the minimum time for the mobility programme to 3 months.

33. ***Commercialization:*** Most interviewees are convinced that GEN-AU succeeded in showing researchers the importance of IPR and commercialization of research results. Nevertheless it has been mentioned that it is still necessary to increase the awareness of scientists of patent issues, especially regarding prior art and what is patentable. The aim of GEN-AU to create a large number of patents and start-ups is generally described as positive, very ambitious, but nevertheless illusory. This view can, however, to a certain extent also be linked to the current economic context of the area.

    The programme management should consider a closer cooperation with aws to build up awareness on patents and information on instruments regarding commercialization. Existing trainings could, for example, be promoted and/or supported.

34. ***IPR: Needs of Companies:*** A small number of company based interview partners suggested that the needs of companies be taken more into account when IPR issues are concerned. One interviewee even said that IPR issues have to be set up in a way that will interest industry. It is necessary to state that the absorption capacities of the industry in Austria are limited in this area (only a limited number of companies are involved in preclinical research), and companies often have other main foci and lines of business than those derived from GEN-AU. Another interview partner suggested making industry-science cooperation obligatory to improve technology transfer. However, this would change the focus of the entire programme and is not suggested by the evaluation team.

    The programme management and the aws should discuss the needs of companies and determine if there is a need for improving (or fine tuning) the way IPR is addressed within GEN-AU.

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1 Introduction

With this report, the evaluation team provides the final results of the interim programme management evaluation of the "Austrian Genome Research Programme GEN-AU".

Motivation of the team

Joanneum Research (like TIA Consulting and the Austrian Institute for SME Research) is an organisation possessing know-how on the evaluation of initiatives concerning policy in the areas of research and technology and exhibiting adept, methodical skills as well as broad international experience. Rosalie Ruegg (of TIA Consulting) was director of the Advanced Technology Program's (ATP) Economic Assessment Office for many years. ATP is an institution in the USA that is renowned for carrying out technology programmes and implementing evaluation studies of those programmes that are deemed to be at the forefront of worldwide methodology and practice. The Austrian Institute for SME Research is specialised in social and economic research with focus on small and medium sized enterprises (SMEs). The evaluation of innovation and technology programmes and policies is one of the main research areas of the institute. Jacqueline Allan, Forfás Ireland, joined Joanneum Research as guest researcher during the realization of the evaluation.

Focus of the report

The quality of the projects carried out in GEN-AU is not in the focus of this report. Instead our aim is to supply the ministry as well as the office of the Research Programme GEN-AU with a basis for decision-making in determining whether the programme in its present form should be continued. With this evaluation we intend to point-out possible room for improvement of GEN-AU, especially within the everyday processes. In addition, we provide the ministry with support when it comes to adequately preparing a subsequent impact analysis.

How we proceeded

In order to provide stakeholders with valuable information and opinions, we applied a methodology mix to the evaluation exercise. We concentrated on qualitative methods because of the focus on processes and learning, and because of the fact that there is still considerable amount of time left for completion of most of the funded projects.

Suggestions on how to continue

Evaluations are not carried out for their own sake; rather, they provide knowledge which should lead to concrete action. We try to present evaluation results in an efficient and readable way and expect that the evaluation results will, directly or indirectly, support decision-making processes in this particular programme. For this purpose we provide a set of specific options and recommendations. Our judgements and recommendations are not only marked throughout the report but also summarized (identically) at the beginning and at the end of the document.

2 Aims, Structure and Methods of the Evaluation

2.1 Aims

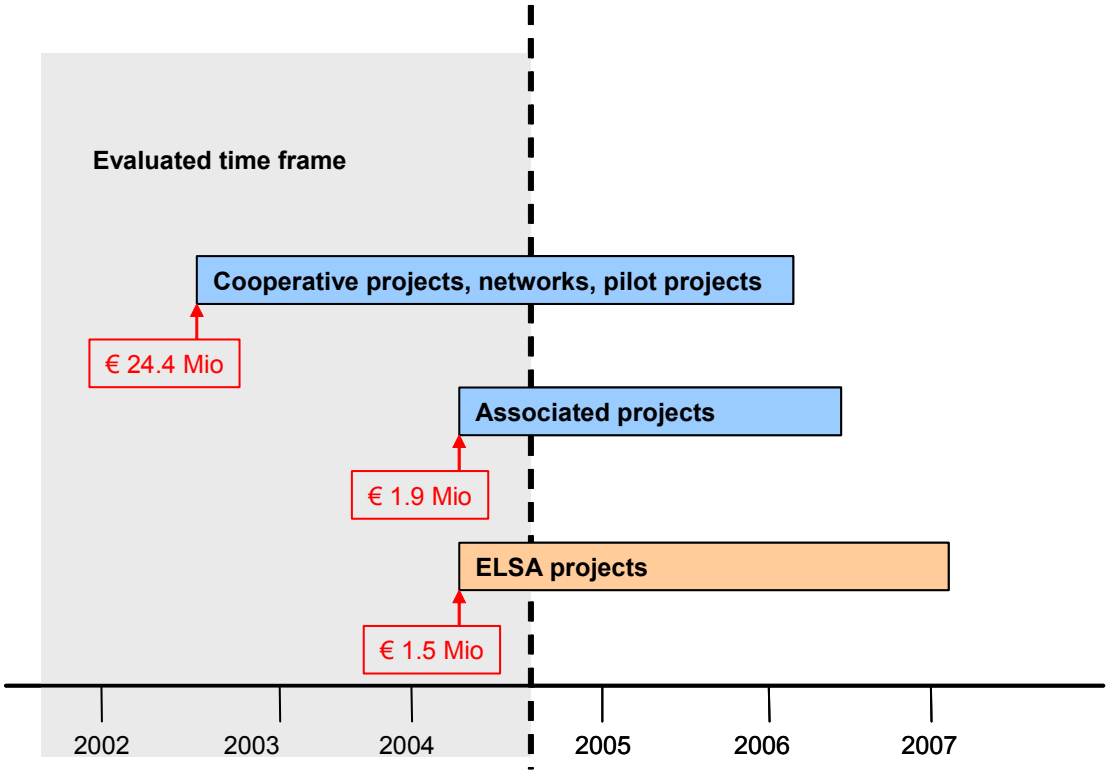
With this report, the evaluation team supplies the ministry as well as the office of the research programme GEN-AU with a basis for decision-making to determine whether the programme in its present form should be continued, and, if so, how it can be improved.

We intend to

- point-out possible room for improvement, especially within the management processes and
- provide support when it comes to adequately preparing a subsequent impact analysis.

When specifying the aims of the evaluation the evaluated timeframe (Sept 7, 2001 to July 31, 2004; see also Graph 1) has to be taken into consideration. We started this evaluation in late September 2004. This means that only a minority of projects were about to be finished; some of the projects (e.g. ELSA) started just some months before.

Graph 1 Evaluated time frame



Source: Joanneum Research

The evaluated time frame determined our methodological approach, the evaluation design and the kind of information we obtained from our interviewees.

It should be noted, too, that the design process for phase II of GEN-AU was more or less completed when the evaluation team started its work. During the evaluation the first two calls for phase II of GEN-AU were launched and some information on these calls is also included in this report. Due to the given timing the results of this evaluation can only be taken into consideration for later stages of the programme.

2.2 Structure

While chapters 1 and 2 explain the motivation of the team, the focus of the evaluation task and the methodological approach, chapter 3 provides the reader with historical background on the programme. We describe in much detail the different project types existing in GEN-AU (cooperative projects[1], networks, pilot projects, associated projects and ELSA projects), and give an overview on all players involved with GEN-AU, beneficiaries, budgets, project sizes and regional aspects. We also describe the programme partners and their tasks within GEN-AU. Section 3.5 represents a core feature of the evaluation approach: the logic chart of the programme. This chart may be thought of as the 'heart' of this report as it allows the reader to examine GEN-AU on a single page. Last but not least, we discuss some aspects of daily activities that take place in GEN-AU.

Chapter 4 sheds light on the way the different players network with each other, that is, the way they exchange information and resources.

Chapter 5 assesses proposal review and project selection procedures employed by GEN-AU. We put much emphasis on these procedures, because they seem critical to us for the further success of the programme.

Chapter 6 deals with three aspects of GEN-AU's strategic goals: Female executives, the labour market and young researchers.

Chapter 7 contains portraits of four GEN-AU projects. The purpose of this part of the report is to make GEN-AU more tangible and provide the reader a clearer view of the different project types, their network structures and their tasks. Furthermore, the case studies illustrate many of the findings from the previous chapters.

Chapter 8 gives a short overview of publicly funded genome research programmes from abroad: Genome Canada, biomolecular research in Japan and several grant initiatives in the US. The purpose of this chapter is to show different approaches to boost genome research in a national system and give the GEN-AU decision makers the possibility to get ideas from different programmes. Chapter 8 also contains information on various international ELSA initiatives.

Chapter 9 develops a plan that will provide support to the programme in preparing for future impact assessment. This plan presents recommended performance measures for GEN-AU that are keyed to the programme's goals and mission, and outlines a strategy for implementation. To monitor progress, it also identifies an array of performance measures of activities, outputs, and outcomes from which the programme may select useful indicators of progress towards longer-term impacts, and well as inputs to impact assessment.

Finally, the section entitled "Conclusions, Options and Recommendations" gives an answer to those questions that the evaluation team was asked specifically to address. Options and recommendations address either the policy level or the programme management level. For better readability, we moved this section forward and put it right after the "Executive Summary."

[1] Cooperative projects are often also referred to as coordinated projects in many GEN-AU documents. Throughout the text, only the term cooperative projects will be used.

The appendix provides a list of the interviews conducted in support of the study, documents used, the literature referenced and relevant web sites. It also includes a glossary and information on response rates for the online survey carried out for the social network analysis (SNA).

2.3 Methodology

The evaluation team started from the premise that single method approaches are typically an inadequate way to address evaluation questions. We are convinced that in order to provide stakeholders with valuable information and opinions, it is necessary to apply a methodology mix to evaluation exercises. Although both the qualitative and the quantitative "methodological worlds" are important in evaluation we concentrated on qualitative methods in this project. The reason for the focus on the qualitative methods lies in the nature of the evaluation exercise. It is an interim evaluation with a focus on processes and learning, and there is still considerable amount of time left for the projects to be completed. Hence, we used the following methods:

- Desk Analysis
- Logic Chart Analysis
- International Comparison
- Interviews
- Case Studies
- Social Network Analysis, using a standardized online survey

2.3.1 Desk Analysis

We, the team members, sifted through the programme's planning material, protocols, background studies, promotion documents and we incorporated this information in our evaluation work. As a starting point for this effort, we communicated our information needs in a structured manner to the office of the Research Programme GEN-AU and in response received valuable information, often based on internal statistics and sources.

2.3.2 Logic Chart Analysis

We did a Logic Chart Analysis to obtain common understanding of the programme. Logic Charts are diagrams that assist the user to visualize the connection between the mission, aims, activities, outputs, outcomes and impacts of a programme. Thus, they depict the overall design and reflect the underlying assumptions on which a programme is based. The advantage of such diagrams is the possibility to compile programme logic from the intuition of programme experts. A workshop with members of the GEN-AU Programme Office and the ministry formed the basis for the production of the Logic Chart. This has been used as an information tool for all other steps in this project.

2.3.3 International Comparison

To apprehend alternative means of promoting the development of research and technology in the field of genomics, we looked at public programmes in three other countries: we tried to apprehend what other starting points there may be in the case of other topical programmes that try to promote the development of research and technology in the field. We discuss the mechanisms that are used in these programmes, how projects are selected and the general magnitude of the effort. The question at the centre of this effort was: What can GEN-AU learn from these programmes? We concentrated on programmes in the US, Canada and Japan. In addition, we addressed international ELSA activities.

2.3.4 Interviews

The team understands 'evaluation' as a social process. Therefore, the interaction with the ministry and the GEN-AU team was of special importance. Moreover, we tried to take into consideration the positions, attitudes and agenda of various relevant stakeholders. We also looked beyond the programme to ask the opinion of experts outside the programme. In our opinion, interviews were a crucial method in obtaining a precise picture of the GEN-AU Programme.

We conducted a broad interview programme, including 72 interviews of which 60 were in person, and the rest were by telephone. The interviews were carried out with the following groups: The GEN-AU team (administrative office as well ministry people), the Scientific Advisory Board[2], participants in the projects (4 cooperative projects, 6 pilot projects, 2 networks, 5 associated projects, 6 ELSA projects), programme partners (tecma (aws), dialog<>gentechnik, Science Communications, ÖGGGT, Deutsches Ressourcenzentrum für Genomforschung GmbH and the Austrian Association for Genetics and Genetic Engineering), young researchers, political stakeholders and experts in the fields of labour market policy, higher education and health policy, as well as research and technology policy (e.g., The Austrian Council for Research and Technology Development), international experts in the field of genome research (outside the Scientific Advisory Board), and finally entrepreneurs and scientists that have decided to stay outside the programme.

2.3.5 Case Studies

There are several different types of projects in the GEN-AU programme. At the beginning we acted on the assumption that there are cooperative projects, pilot projects and networks but also flanking projects within the ELSA sub-programme. After studying the different types of projects, the evaluation team selected one project per project type for case study, for a total of four case studies. We collected considerable information for these cases, some of which is confidential. Thus, only short versions free of confidential information are used in this public document. At a later stage of the evaluation we learned about a fifth project type, so-called GEN-AU associated projects. These were not considered for a case study.

2.3.6 Social Network Analysis – SNA

Social network analysis is a tool that allows identifying, simplifying and visualizing network relations, such as communication taking place between different members of a group. This tool was selectively used for some of the stipulated research questions and especially for the analysis of whether there is adequate networking of policy in the areas of science, research, and education within the framework of GEN-AU. The Social Network Analysis draws on an online survey that was carried out using a standardized questionnaire. The online survey was also used for quantifying non-SNA specific issues, namely, possible "Mitnahmeeffekte" (deadweight losses) of the programme and satisfaction with different aspects of GEN-AU.

[2] The Scientific Advisory Board is often referred to as Scientific Advisory Committee (or: SAC) in many GEN-AU documents. Throughout thus text, only the term Scientific Advisory Board (or: SAB) will be used.

Social Network Analysis (SNA)

Social network analysis (SNA) is a long established field in the social sciences[3] which offers not only a theoretical perspective[4] but also a set of methods and instruments with which social relationships may be analysed [5]. Proponents of SNA claim that it offers one of the most promising avenues of research available to social scientists today.[6] The method's main concern is to investigate relationships between individual and collective actors which, from the moment when more than two actors are involved, render the relationship model of a network in terms of morphology. In terms of analytical procedure, SNA aims to provide a clear and transparent means for presenting and analysing interrelations between actors, identifying the positions occupied by specific actors within a network or mapping the structure of communication flows and resource channels between individual actors with all their consequences and outcomes.

The application of network analysis techniques to the evaluation of research processes and policy-driven research development measures is a relatively new field for network analysis, at least as far as continental Europe is concerned.[7] Even so, the deployment of SNA instruments in the context of evaluating research processes can indeed produce some highly pertinent insights.[8] The SNA analysis in the context of the evaluation of the GEN-AU programme, for instance, gives valuable information on the following aspects:

- The quality and intensity of co-operative relationships, information and knowledge exchanges, and the exchange of resources between the various GEN-AU projects and their casts of actors.
- The identification of strategic and peripheral actors and/or projects, *and* the pinpointing of factors critical to project success or failure, thus enabling the identification of the innovation potential of co-operative research.
- Insights on the functionality of the GEN-AU network thus gathered then enable the identification of strategic fields of action and offer ways to optimise the programme management.

More detailed information on the SNA and its set-up for the evaluation exercise will be given in section 4.1.

[3] The emergence of network analysis as a differentiated theoretical perspective and methodological approach is generally ascribed to the early 1970s in the USA and Canada, *Scott* (1991); for a fuller view of SNA see inter alios *Burt* (2001), *Pappi* (1987), *Jansen* (2003); for an overview of current developments in the field see *Kilduff/Tsai* (2003).

[4] It is characteristic for this theoretical perspective that it takes the embeddedness of individual and collective actors in networks as the starting point for explaining their actions and possibilities of action. Thus network theory allows the integration of action theory with theories on institutions, systems and structures.

[5] For an exemplary view on SNA as a method see *Pappi* (1987), *Burt/Minor* (1983).

[6] *Jansen* (2003, p. 48)

[7] *Bührer/Görisch* (2003), *Neurath/Katzmaier* (2003), *Joanneum Research* (2005); for an exemplary view on the application of SNA to the investigation of research networks, see *DFG* (2003).

[8] However, a lengthy, elaborate and time-consuming survey is needed to produce such results. And one of the frequent problems to be overcome is how to induce acceptance on the part of respondents who are asked to give relatively detailed information, including mention of "in-house" or "private" concerns.

3 About GEN-AU

In 2001 the Austrian Federal Ministry for Education, Science and Culture, bm:bwk, launched the 'Austrian Genome Research Programme GEN-AU' (GENome Research in AUstria), “a programme of the future” for Austria. The ministry based this programme “on the good foundations genome research had in Austria at that time and aimed at strengthening, focusing and integrating research capacities.“[9] The genome research programme was planned for a period of nine years. It receives funding every three years and approximately € 10.7 million are spent on GEN-AU each year.

The programme covers research areas that are intended to secure and expand Austria's competitiveness and ability to cooperate on an international level. Efficient and targeted technology transfer measures are to be provided to guarantee the commercial realization of research findings. One of the goals of the programme is to “significantly improve conditions for investment in genomics and biotechnology and support the creation of new jobs.”

Several project types constitute the “GEN-AU project family.” At present, four cooperative projects, six pilot projects and two technological networks are supported. In addition, in 2003 five GEN-AU associated projects were implemented. The project types differ in their structure mainly by number of project partners, project duration and funding volume. In May 2003, the ministry launched the accompanying research programme ELSA, which deals with the ethical, legal, social and economical impact of genome research on society. Six ELSA projects were selected for funding.

GEN-AU does not stop at promoting research. Public relations activities sensitive to social responsibility, support of young researchers, and commercialisation of results are important issues in GEN-AU, too.

Table 1 The GEN-AU team

Mag. Markus Pasterk	bm:bwk: deputy director general, responsible for GEN-AU until November 04
Mag. Elisabeth Tischelmayer	bm:bwk: head of division, responsible for GEN-AU since November 04
Mag. Katja Fiala	GEN-AU Programme Office: programme manager
DI Maria Bürgermeister	GEN-AU Programme Office: programme manager
Alexandra Fuchs	GEN-AU Programme Office: programme manager

The GEN-AU team consists of five people and is composed of the Programme Office and the relevant people in the ministry (see Table 1) The Programme Office is responsible for the smooth handling of all administrative aspects of the programme; the ministry is the strategic decision maker – ‘strategic’ in a research and technology policy sense.

GEN-AU was planned to operate for nine years and was divided into three project phases; the beginning of 2005 marks the start of phase II.

The Austrian federal government has made a total of € 31.74 million[10] available to finance the first project phase. Four ‘cooperative projects’ are supported. The projects involve several Austrian research teams. A supporting network helps to create and integrate bioinformatics resources. An additional platform deals with the field of proteomics. A total of six pilot projects are focused on very specific questions in plant and animal genomics as well as human diseases. Five GEN-AU associated projects and six ELSA projects complete the portfolio of GEN-AU. ELSA projects deal with ethical, legal and social aspects of genome research in general and GEN-AU project topics specifically.

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9 http://www.gen-au.at, March 12, 2005

10 Plus € 1.85 million additional budget, see also the section on ‘associated projects’

3.1 GEN-AU: The Historic Perspective

The idea to start a programme like GEN-AU was born in the ministry in the late nineties (about 1998). It was then that stakeholders in the ministry saw "*the potential of biotechnology in general and its importance for Austria in particular*." (Interview Tischelmayer). The actual design process (see also Table 2) for the programme started in 2000. In January 2000 there was a first workshop with people working in the field of molecular biology. The ministry wanted to know what research activities had been going on in the field in Austria, how funding had been organized in other countries, especially in Germany and also the motivation for industry to participate in such research programmes. At that time, the topic was also on the European research agenda, particularly within the scope of the 5th EU-Framework Programme (Quality of Life). In his interview, Markus Pasterk specified: "*The question was: what can we provide in Austria? We need a national programme to prepare our scientists for EU-funding and better access to these funding schemes. At this time we had no structure supporting that new field. There was also not really a focused work on the industry level at this time; only small project funding in the field of academia. Together with BIT*[11] *we started then a call for interested scientists who had many ideas and gave us a positive feedback. With these ideas we started formalizing the process, a committee was established for writing a concept, mission statement etc. There were some additional workshops, also with industry representatives. We had also a colleague from Germany who was in Austria for two months, within the scope of a civil servant-exchange" (Dr. Frank Laplace.)*

Table 2 Steps in the design process of GEN-AU

Step 1	
	Informal talks, information collection on biotechnology and genome research; 1998, 1999
Step 2	
	Workshop with scientists and people working in the field of genome research; 2000
Step 3	
	Research Catalogue[12]: A Catalogue of all relevant research groups and projects was edited by BIT and bm:bwk. Networking Day: Organized together with BIT; the aim was to bring together all relevant groups in the field; 2000
Step 4	
	A working group was established to formulate a strategic paper to motivate and design the programme: 'Strategiepapier'[13]; 2001
Step 5	
	A German expert (Dr. Frank Laplace) helped to design the programme after having designed a related programme in Germany; 2001
Step 6	
	The Austrian Council for Research and Technology Development commissioned an ex-ante evaluation by two professors in the field of Genome Research. This evaluation was the basis for the decision of the Council to recommend earmarking money for GEN-AU[14]
Step 7	
	The Scientific Advisory Board was asked to give a final judgement and comment on the programme design. The minister accepted the basic elements of the strategy paper in 2002.

[11] Author's note: BIT - the Bureau for International Research and Technology Cooperation - is the Austrian centre offering services to participants in European and international programmes, actions and initiatives for cooperation in research and technological development. BIT was incorporated into the Austrian Research Promotion Agency FFG and now forms the division for international research and technology development.

[12] *BIT/ bm:bwk* (2000): Networking Day – Genomics

[13] *bm:bwk* (2001): Strategiepapier zum Österreichischen Genomforschungsprogramm GEN-AU

[14] unpublished

Comments by the evaluation team

Considerable effort has been put into the design process of GEN-AU (see also Table 2). A German expert in the field of programme management was involved in the design process; a group of scientific experts was invited to formulate a "strategic paper" to position the programme; a networking day was organized to bring together all relevant researchers in the field; a catalogue of all these players has been produced; the Austrian Council commissioned an ex-ante evaluation, and finally a Scientific Advisory Board was formed and asked to bring in an additional view on the text of the first call. This can be seen as a thorough process and is quite above 'Austrian standards.'

However, some of the interview partners stressed the fact, that, in the end, only groups with a high and established reputation got money out of GEN-AU. So they thought of the networking activities in the preliminary stages of GEN-AU as a vain endeavour. We think this is not a valid critique of the design process. As long as the programme was designed to allow all possible beneficiaries in principle to participate in the programme, and a fair project selection process was established, the design process appears acceptable and appropriate.

So, considerable effort has been put into the programme design process of GEN-AU, but did it pay off? We believe (and lots of interviews corroborate this) that the programme got a different spin after its launch. The ministry started GEN-AU as a programme with a rather applied focus (e.g., an industry platform had been planned), and at least some of the applicants trimmed their proposals in that direction. However, the Scientific Advisory Board had a different view on what should be achieved within GEN-AU and selected projects with a "basic" rather than "applied" focus. It is clear that there were certain misunderstandings on what the ministry (as opposed to the Scientific Advisory Board) wants to achieve with the programme. (See also the following chapters, especially chapter 5)

It was not clear from the beginning that there would be different project types. So the applicants applied for cooperative projects and nothing else. There was a lack of transparency regarding the project types created after the call for proposals. There was no clear communication on who developed the different project types, and why they were developed. Therefore, lots of rumours are out there ("there was money left," "the ministry wants to give money to certain groups," "there were parts of rejected cooperative projects the SAB did not want to loose," etc..)

In addition, the possibility of conflicts of interest regarding project selection, evaluation and realization appears not to have been eliminated.

3.2 Project Funding in GEN-AU

Project funding is the central funding instrument of GEN-AU and the predominant part of the budget goes directly into research projects. In phase I of GEN-AU € 27.83 million have been allocated to 23 projects that are grouped in five different project types:

- Cooperative projects
- Networks
- Pilot projects
- Associated projects
- ELSA projects

These project types will be described in more detail at a later stage. Table 3 and Table 4 give some general information on the different project types. The numbers of projects per project type as well as the corresponding funding volumes are summarized in Table 3. We would like to point out that cooperative projects received most of the money and ELSA projects least.

Table 3 Projects in brief: Numbers and funding volume per project type

Project type	Number of projects	Total funding volume	Average funding volume
Cooperative projects	4	€ 16,358,819	€ 4,089,704.75
Networks	2	€ 3,711,262	€ 1,815,631.00
Pilot projects	6	€ 4,319,804	€ 719,967.33
Associated projects	5	€ 1,914,344	€ 382,868.71
ELSA projects	6	€ 1,526,505	€ 254,417.50
Sum	23	€ 27,830,734	
Mean value		€ 1,210,032	

Source: GEN-AU; adapted by Joanneum Research

In Table 4 the numbers of project partners are given. In addition, the average project duration is shown. The number of partners differs depending on the projects type. The project duration is up to three years.

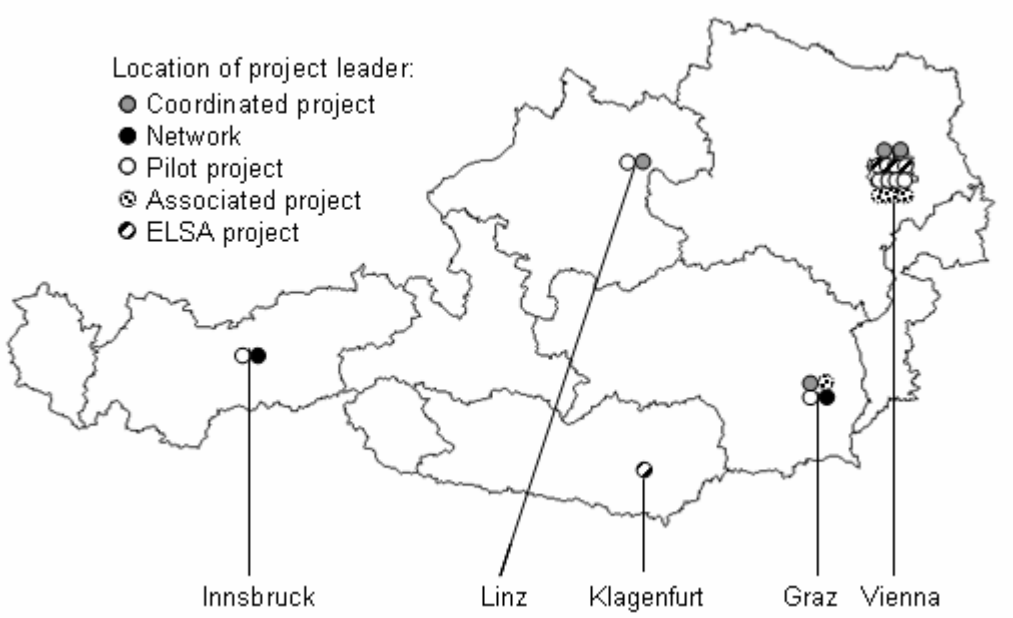
Table 4 Projects in brief: Numbers of partnering institutions per project type

Project type	Total number of partnering institutions	Average number of partnering institutions	Average duration (years)
Cooperative projects	27	6	3
Networks	17	9	3
Pilot projects	19	3	2.7
Associated projects	11	2	2
ELSA projects	17	3	2.5
Sum	91		
Mean value	4		

Source: GEN-AU; adapted by Joanneum Research

The local distribution of the funded projects is given in Graph 2. Please note that for each project only the location of the project leader is shown. This does not mean that the whole project is actually carried out at this place. To the contrary, most projects involve different research institutions throughout Austria.

Graph 2 Local distribution of GEN-AU projects: Locations of project leaders



Source: Joanneum Research

Comments by the evaluation team

The concentration of project leaders in Vienna is not surprising as Vienna has long been known as the Austrian centre for bio-scientific research. Graz and Innsbruck are also often quoted as locations of excellent researchers in the field. Nevertheless, these cities are said to be of less importance when compared to Vienna.[15]

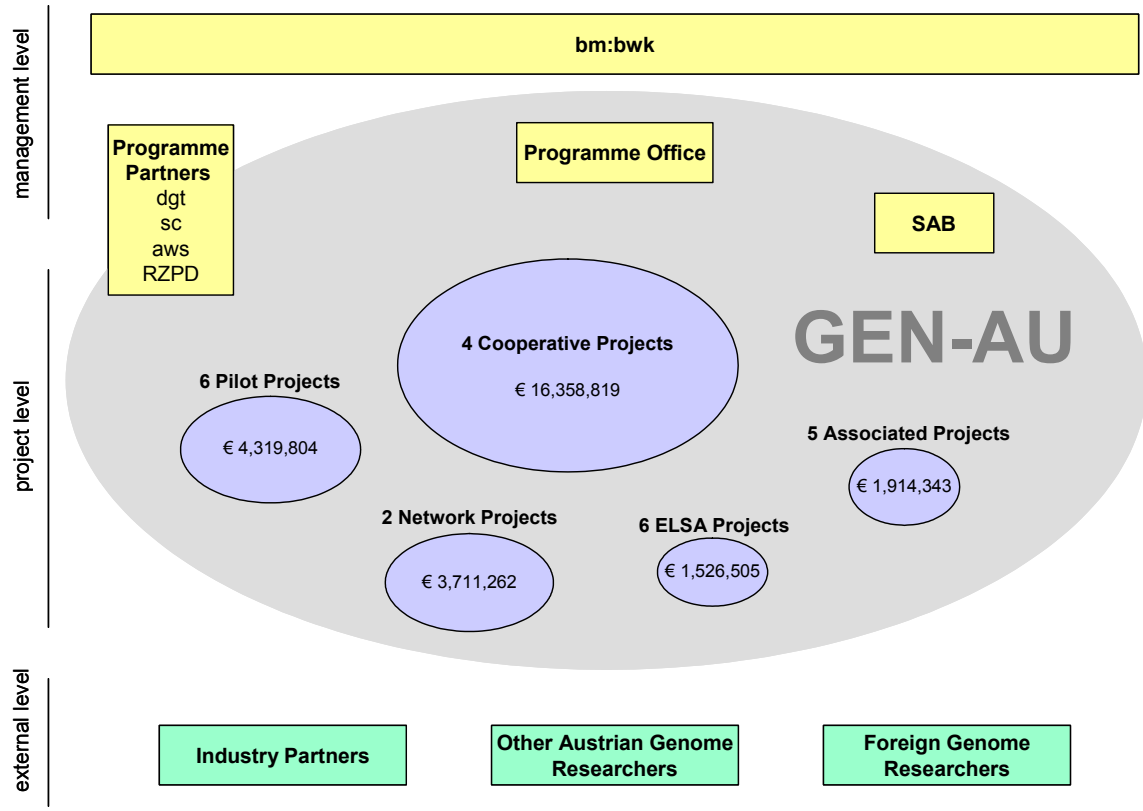
3.3 Major Players involved with GEN-AU

Graph 3 shows the cast of actors categories involved with GEN-AU. We distinguish 3 levels: The Federal Ministry (bm:bwk), the Programme Office, the SAB and the programme partners are situated at the **management level**. A total of € 27.83 million has been allocated to 23 projects which are placed at the **project level**. These projects form the very heart of GEN-AU. Each ellipse stands for a project type with its subprojects. Total funding is proportional to the area of the ellipses. As they are important for the work of GEN-AU researchers, the system of players also includes industry partners, foreign and other Austrian genome researchers (not involved with GEN-AU) who are positioned at the **external (periphery) level**. The core of GEN-AU (the GEN-AU programme as such) is the grey-shaded area.

The following sections will be devoted to describe the most important players (especially the project types) and their roles in GEN-AU in more detail.

[15] e.g. *Boston Consulting Group* (2002)

Graph 3 Players/Cast of actors in GEN-AU



Source: Austrian Institute for SME Research

3.4 Project Types

3.4.1 Cooperative Projects

One goal of GEN-AU is to stimulate Austrian researchers in the field to work together, to form critical masses.[16] This is reflected in the design of the funding instruments. The first call within the GEN-AU programme was launched in September 2001[17] and it was exclusively aimed at interdisciplinary cooperative research projects. These cooperative projects are required to involve at least four working groups from academia and/or industry. All other project types (except ELSA) came into play later on and were not an integral part of the programme from the beginning.

Cooperative projects can be regarded as the heart of GEN-AU as it was conceived. In phase I of the programme roughly € 16.4 million went into this type of projects. That is nearly 50 % of the total budget.

[16] e.g. *bm:bwk* (2001): Strategiepapier zum Österreichischen Genomforschungsprogramm GEN-AU and *bm:bwk* (2002): Richtlinien des Österreichischen Genomforschungsprogramms GEN-AU

[17] *bm:bwk* (2001): Ausschreibung zur Förderung des „Österreichischen Genomforschungsprogramms GEN-AU“

According to the GEN-AU policy paper as well as the call text, cooperative projects had to be focused on:

- "Genome research (in context with genome structure and function on the level of transcription, the proteome, cellular functions/processes and the phenotype) *and*
- Implementations with immediate or via health of keeping animals and plants mediated relevance for the health of human beings including their commercial utilization"

The call documents specify five research topics that could be targeted: Analysis of structure and sequence of genomes, expression analysis, functional analyses, bioinformatics, links between genome research and pharmacology, medicine, biotechnology, agriculture as well as forestry. In addition, four to nine subtopics have been listed in the documents per category. In response, projects should have been proposed that deal with these topics/subtopics. Cooperative projects receive funding for up to three years. The minimal funding volume of a single project is stated to be about € 1.96 million per year. And in general, only Austrian research groups were entitled to receive GEN-AU funding. External researchers were nevertheless invited to move to Austria to take part in a project.

Table 5 summarizes the characteristics of the four cooperative projects funded in phase I of GEN-AU. The projects involve up to nine partnering institutions. In the project led by Thomas Jenuwein only three partnering institutions are involved. However, one of them hosts three out of five working groups collaborating in this project. Like all other cooperative projects this project, therefore, meets the requirement for cooperative projects to include at least four working groups.

Regarding the funding volumes it can be noted that none of the projects reaches the minimum funding volume per year stated in the main call document. With the aforementioned € 1.96 million per year the total funding volume would have been at least € 5.88 million for a three-year project. The announced minimal funding volume and a graph given in the very first GEN-AU folder[18] indicate that in the beginning much larger cooperative projects were intended. This is said to have changed in response to the structure of the Austrian Life Sciences scene, which is mainly comprised of smaller units.

Table 5 Cooperative projects in numbers

Project leader	Project title	Funding	Time scale (years)	Partner institutions
Gerhard Schütz	Ultra-sensitive Proteomics and Genomics	€ 5,244,095	3	9
Rudolf Zechner	"GOLD" - Genomics of Lipid-Associated Disorders	€ 4,086,655	3	6
Wolfgang Rettig	Genomic Approaches to Tumor Invasion and Metastasis	€ 3,574,623	3	4
Thomas Jenuwein	Epigenetic Plasticity of the Mammalian Genome	€ 3,453,446	3	3
Sum		€ 16,358,819	12	22
Mean value		€ 4,089,705	3	6

Source: GEN-AU; adapted by Joanneum Research

[18] *GEN-AU* (2001): Forschung im Dialog

Phase II of GEN-AU will again involve cooperative projects.[19] The call for cooperative projects has already been closed. Twenty nine short proposals for cooperative projects were handed in. These are now being evaluated. No special conditions for those people that received funding in phase I of GEN-AU have been communicated.

There are a number of changes in the new call documents when compared with the old ones:

- The overall topic of funding has been extended: In addition to projects in genome research projects in systems biology are now eligible, too.
- Cooperative projects can now either focus on applications in the broader context of human health or on sustainable development of resources.
- ELSA subprojects can be integrated into cooperative projects.
- In the new call for proposals no detailed subtopics are specified that are to be picked up in research proposals.
- The minimum number of partners has been reduced to three.
- In special well-founded cases research organizations from abroad can receive GEN-AU funding, too.

These points taken together can be considered to constitute a major change in strategy.

3.4.2 Networks

Bioinformatics and proteomics are regarded as being very important to the Austrian Genome Research Programme by its Scientific Advisory Board and the Ministry of Education, Science and Culture. According to our interview partners from the GEN-AU office and the ministry, only a limited number of proposals for cooperative projects dealing with bioinformatics and proteomics were submitted for the first phase of the programme. This is said to be the reason why all Austrian researches working within these two fields have successively been invited by the ministry to create networks. These networks are considered to comprise technology platforms that should provide support services within their areas of speciality for all other GEN-AU projects.[20]

Table 6 provides general information on the two networks currently supported by GEN-AU. Both networks are funded for three years. They also receive roughly the same amount of funding, which is € 1.7 million and € 1.9 million, respectively. However, there are considerable differences with regard to the number of partnering institutions. While five institutions take part in the Austrian Proteomics Platform, more than twice as many (twelve institutions) participate in the Bioinformatics Integration Network.

Table 6 Networks in numbers

Project leader	Project title	Funding	Time scale (years)	Partnering institutions
Lukas Huber	Austrian Proteomics Platform	€ 1,977,310	3	5
Zlatko Trajanoski	Bioinformatics Integration Network	€ 1,733,952	3	12
Sum		€ 3,711,262	6	17
Mean value[21]		€ 1,855,631	3	9

Source: GEN-AU; adapted by Joanneum Research

[19] *GEN-AU* (2004): Leitfaden zur Vorbereitung der Kurzanträge für Verbundprojekte im Rahmen der zweiten Ausschreibung des „Österreichisches Genomforschungsprogramm GEN-AU“ and *bm:bwk* (2004): 2. Ausschreibung zur Förderung von Verbundprojekten im Rahmen des „Österreichischen Genomforschungsprogramms GEN-AU“

[20] *GEN-AU* (2003): Genome research for health

[21] Mean values are only given for completeness

Phase II of GEN-AU will involve networks, too. Currently the respective call is closed. Nine proposals for networks have been submitted that are now being evaluated. According to the call documents,[22] a network should involve at least three academic and/or industry based research groups. These should represent the available Austrian expertise in the respective area of research. Networks have to focus either on specific technologies or resources for genome research. Within networks technologies or methods should be developed. In addition, networks have to be regarded as training and education platforms. Like cooperative projects, networks can receive funding for up to three years. Again, no special conditions for existing networks seeking prolongation are laid out in the call documents for phase II.

3.4.3 Pilot Projects

The idea to support pilot projects was only developed during the evaluation phase of proposals for cooperative projects in the first phase of GEN-AU. According to our interview partners in the GEN-AU office and the Ministry of Education, Science and Culture, some of the proposed projects were not recommended for full funding, but contained excellent parts that some members of the Scientific Advisory Board regarded as valuable for the Austrian Genome Research Programme. Apart from that, the argument was mentioned that certain technologies were not considered ripe for application in a big cooperative project. In any case, a need for smaller projects was identified and an appropriate funding instrument created. Because of their impromptu origin, pilot projects have a rather soft definition in phase I of GEN-AU. They are funded for up to three years and should allow scientists to test a research hypothesis in a smaller, shorter framework. The obtained results may allow the participating researchers to apply for a cooperative projects later on.

Basic information on the six pilot projects funded in phase I of GEN-AU is given in Table 7. Projects involve one to six partnering institutions and last two or three years. One of the two-year projects has been extended and continues for a third year. The funding volume of pilot projects varies between € 0.4 million and € 1.1 million.

For phase II of GEN-AU, pilot projects are included from the beginning. The respective call documents are currently in preparation (October 2004). According to our interview partners at the GEN-AU office and the Ministry of Education, Science and Culture, future pilot projects shall involve only up to two partners and investigate a single aspect of a certain topic. Their duration shall also be restricted to one year. Three to four deadlines for submitting proposals are planned; these will be in summer and winter both in 2005 and 2006.

[22] *GEN-AU* (2004): Leitfaden zur Vorbereitung der Kurzanträge für Netzwerke im Rahmen der zweiten Ausschreibung des „Österreichisches Genomforschungsprogramm GEN-AU“ and *bm:bwk* (2004): 2. Ausschreibung zur Förderung von Netzwerken im Rahmen des „Österreichischen Genomforschungsprogramms GEN-AU“

Table 7 Pilot projects in numbers

Project leader	Project title	Funding	Time scale (years)	Partnering institutions
Kurt Zatloukal	A Comprehensive Disease Bank for Functional Genomcis	€ 1,087,136	3	5
Günther Bonn and Lukas Huber	Proteomics in Tumor Biology	€ 987,156	3	2
Gerhard Adam	Virulence Mechanisms of the Plant Pathogenic Fungus *Fusarium graminearum* and Resistance Mechanisms in Host Plants	€ 795,612	2	6
Reinhard Kofler and Heinrich Kovar	Functional Genomics of Childhood Malignancies	€ 599,810	3	3
Thomas Czerny	Functional Analysis using the "Screen-Out" Method	€ 450,090	2	2
Josef Penninger	Cancer in the Hematopoietic (Blood-Forming) System	€ 400,000	3	1
Sum		€ 4,319,804	16	19
Mean value		€ 719,967	2.7	3

Source: GEN-AU; adapted by Joanneum Research

3.4.4 Associated Projects

During phase I of GEN-AU a few project ideas related to genome research and international cooperation were forwarded to the bm:bwk. The ministry decided to finance these projects using ministerial funds. In 2004, the Austrian Council for Research and Technology Development recommended extra funding for genomic research. Following this recommendation, € 1.848 Mio were added to GEN-AU for new projects. As a result, a new type of project (the so-called associated projects) was created. However, there was no call for these projects and no competition with other project proposals took place.

Table 8 summarizes basic data for the funded associated projects. Projects last one to three years and involve between one and four partnering institutions. The funding volumes go from € 94,000 to nearly € 590,000.

Table 8 Associated projects in numbers

Project Leader	Project Title	Funding	Time Scale (years)	Partnering institutions
Teresa Wagner (Medizinische Universität Wien mit Stanford University)	Proteogenomics of Breast and Ovarian Cancers	€ 582,222	2	4
Heinz Redl (Ludwig Boltzmann Institut für experimentelle und klinische Traumatologie)	Genetic Response according to the Type of Microbial Infection during Sepsis (GRAM)	€ 450,000	3	3
Robert Zeillinger and Sepp Leodolter (Ludwig Boltzmann Institut für Gynäkologie und Gynäkologische Onkologie)	Disseminated Tumor Cells in Gynecologic Oncology	€ 400,000	2	2
Michael Wagner (Department für Mikrobielle Ökologie, Universität Wien)	Environmental Chlamydia Proteomics	€ 388,122	1.5	1
Kurt Zatloukal (Institut für Pathologie, Medizinische Universität Graz)	A Genome Wide and Highly Standardised Gene Expression Data Set for Breast Cancer	€ 94,000	1	1
Sum		€ 1,914,344	9.5	11
Mean value		€ 382,869	2	2

Source: GEN-AU; adapted by Joanneum Research

3.4.5 ELSA Projects

GEN-AU not only supports natural sciences, but also addresses the social sciences and the humanities. Within GEN-AU a special sub-programme was created, the so-called "Accompanying research programme ELSA".[23] ELSA refers to **e**thical, **l**egal and **s**ocial **a**spects. By means of this accompanying research programme the effects of genome research on society are to be investigated.

Accompanying research was planned from the beginning but started with a one year delay. This delay was intended to allow for experience with the management and administration of other project types to be built up and be included in the set-up of ELSA (Interview Bürgermeister and Fiala). According to the call documents, ethical, legal, political, economic, social, communication and philosophical questions may be addressed in ELSA projects. The call text stated that an orientation of the research questions of ELSA projects toward existing GEN-AU projects would be of interest. Also risk assessment and gender-specific questions are said to be possible.

The projects may take up to three years. For ELSA projects a total of € 1.5 million was available in phase I of GEN-AU. No minimum number of partners was specified.

Table 9 provides general information on the ELSA projects approved in phase I of GEN-AU. These projects take two to three years and involve two to four partnering institutions. On average the projects are funded with € 0.25 million.

[23] *bm:bwk* (2003): Ausschreibung zur Förderung des „Begleitforschungsprogramms ELSA" and *GEN-AU* (2003): „Accompanying Research Program ELSA", Explanatory Notes

Table 9 ELSA projects in numbers

Project leader	Project title	Funding	Time scale (years)	Partnering institutions
Helge Torgersen	Post-Genomics and Complexity	€ 317,149	3	4
Herbert Gottweis	Transforming Health Policy: Biobanks, Pharmacogenomics, and the Governance of Biomedical Research	€ 307,044	2	4
Ulrike Felt	Let's talk about GOLD	€ 306,687	3	2
Michael Hubenstorf	Scientific Backwardness & the Burden of Ideology	€ 264,093	3	2
Maria Hofmarcher	Biotechnology and Gender	€ 221,338	2	3
Wilhelm Berger	Prenatal Testing: Individual decision or Distributed Action?	€ 110,194	2	2
Sum		€ 1,526,505	15	17
Mean value		€ 254,418	2.5	3

Source: GEN-AU; adapted by Joanneum Research

In phase II of GEN-AU, ELSA projects will also be supported. In addition to a separate call for ELSA projects, there is the possibility to integrate ELSA subprojects into cooperative projects.[24]

3.4.6 Measuring Additionality and „Mitnahmeeffekte/"Deadweight Losses" and its Limitations

Without having had the possibility to revert, for example, to a control group, this report can only give some hints on additionality or so-called 'Mitnahmeeffekte'[25] (deadweight losses)[26] of GEN-AU: First of all, it is concept that is currently not defined in the context of basic research. There is, as a general rule, no private funding for basic research. Hence, it is generally still not quite clear what is meant by additional effects in basic research: e.g. changes in behaviour, in the kind of research, in the researcher's willingness to network, etc.

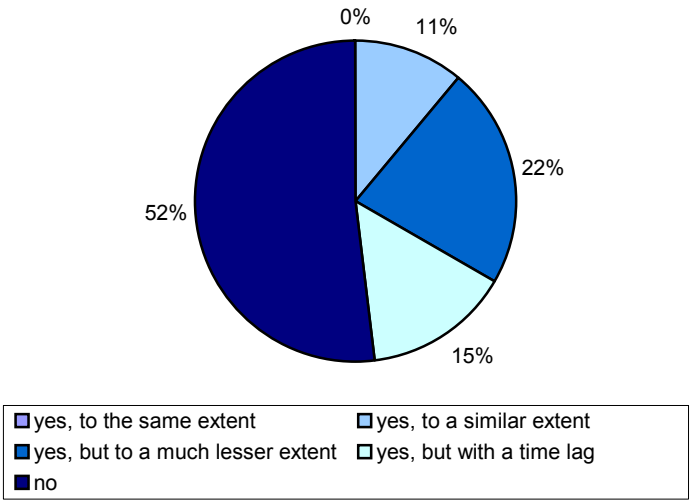
We used the question "would the project have been carried out without support from GEN-AU?" as a first indicator for such effects. The programme seems to exhibit effects, that public funding should intend to achieve (see Graph 4): More than half of the project leaders stated in the course of the online survey that their projects would not have been carried out at all without support from GEN-AU. Around 22 % explained that their project would have been implemented anyway, but on a smaller scale. Approximately 15 % would have expected a delay for starting the project, if GEN-AU funds were not at their disposal. 11 % suggested that the projects would have been carried out to pretty much the same extent.

[24] *bm:bwk* (2004): 2. Ausschreibung zur Förderung von Verbundprojekten im Rahmen des „Österreichischen Genomforschungsprogramms GEN-AU"

[25] A substitution of public funding for private funding- i.e., a shift of who pays for the research with no net gain to society because the net amount/type of research remains unchanged.

[26] There is no proper translation for the German term "Mitnahmeeffekte" in the evaluation literature; the term 'deadweight losses' does not grasp the whole concept of "Mitnahmeeffekte". `Mitnahmeeffekte' can be seen as the opposite concept to "additionality" and may be clearer to the reader than the more popular "additionality".

Graph 4 **'Mitnahmeeffekte' of the GEN-AU programme (Answers to the question: "Would the project have been carried out without support from GEN-AU?")**



N=27
Source: Austrian Institute for SME Research

Comments by the evaluation team

Two shares in this graph (15 % would have started their projects later, 11 % would have been carried out to pretty much the same extent) are surprisingly high and cause some distrust (especially when taking into account the high funding volumes of GEN-AU, which are about 1/10 of the regular annual budget of the Austrian Science Fund FWF). Who would have funded their research in the absence of GEN-AU? One could argue though that some people expected the GEN-AU money to be included in other programmes or within the contract research budget of the ministry. If this assumption were true, 26% answered this way because they assumed they could have gotten the funds through the FWF (or the ministry) instead of GEN-AU, and, hence, would have been able to do essentially the same research either way.

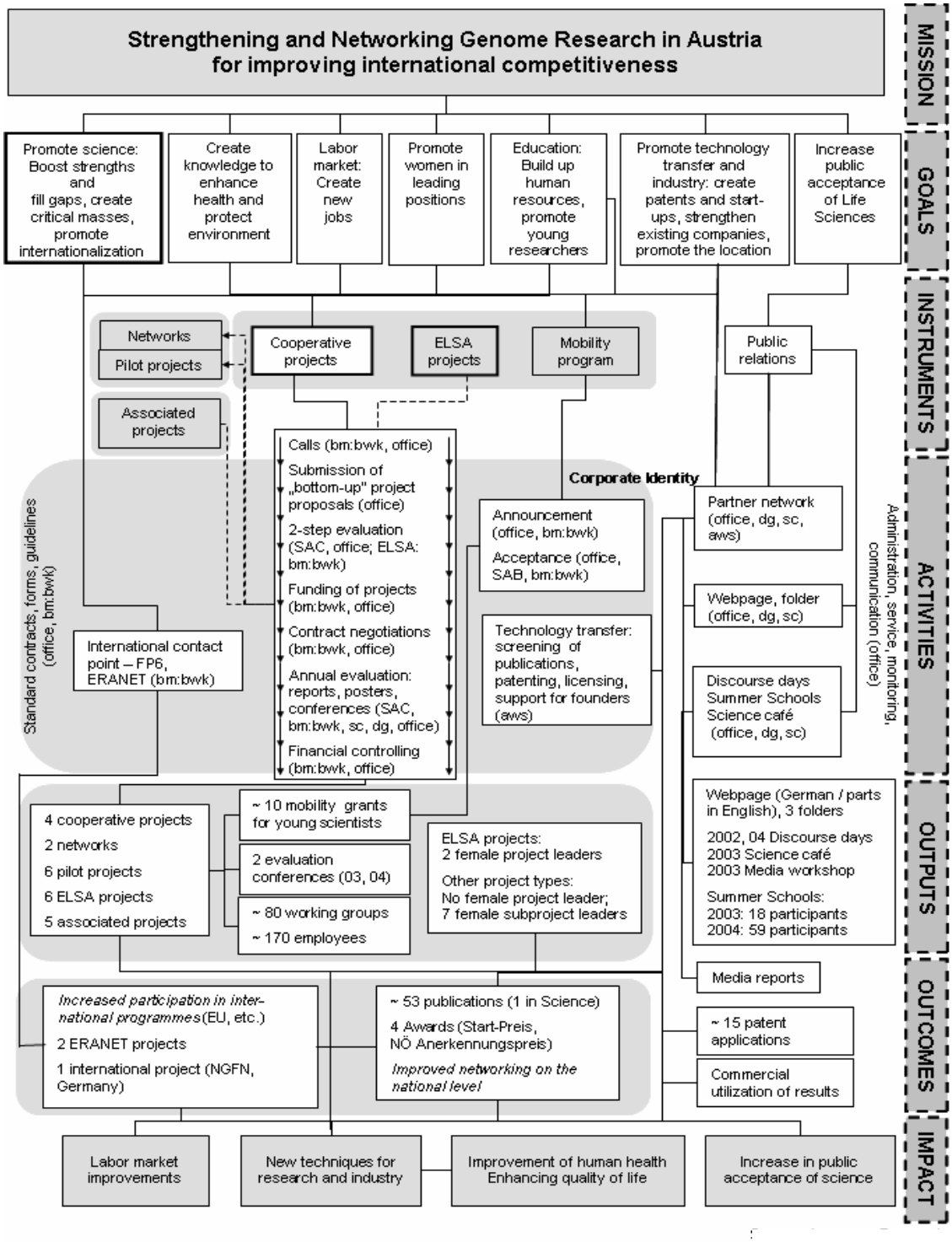
Nonetheless, no pure deadweight effects were recorded (that is, nobody believed that the projects would have been implemented to the same extent without GEN-AU).

We think that a future impact analysis of GEN-AU should carefully look at 'Mitnahmeeffekte'. Furthermore, a coherent conceptualisation of 'Mitnahmeeffekte'[27] in the field of basic research is also a task for the future.

[27] "General University Fund versus other sources" could be a first step in this conceptualisation.

3.5 GEN-AU: Logic Chart

Graph 5 Logic-Chart for GEN-AU



Source: Joanneum Research, as of November 2004. Some figures in the chart (especially outputs and outcomes) are dynamically changing over time.

The Logic Chart in Graph 5 has been produced in collaboration with members of the GEN-AU office and the ministry. It has been created to allow one to visualize the mission, the goals, instruments, activities, outputs, outcomes and impacts of GEN-AU, and to see how they fit together. These issues and their interconnections are displayed on a single page by means of the chart. The chart allows us to look at the general programme structure and to identify inconsistencies as well as gaps in the programme; it is nevertheless only a snapshot of a complex process[28].

With the Logic Chart, the evaluation team could identify the most important propositions and conclusions that are the basis of the programme: 'Strengthening and networking genome research in Austria for improving international competitiveness' is clearly the mission of GEN-AU.

Moreover, the ministry and the GEN-AU office specified a broad variety of goals connected with the above stated mission: 'promote science', 'create knowledge to enhance health and protect environment', 'create new jobs', 'promote women in leading positions', 'promote young researchers', 'promote technology transfer' and 'increase public acceptance of life sciences'.

The ministry has chosen seven types of instruments to achieve these aims: first (and most important) there are five types of projects: cooperative projects, pilot projects, networks, ELSA projects and, finally, associated projects.[29] These projects are complemented by the mobility programme, but also by public relations instruments.

On the activities level, a number of different actions beside typical programme management activities were identified (administration, service, monitoring, communication, standard forms, standard contracts, guidelines), the ministry[30] serves as an international contact point: on the one hand, within the structures of FP6, on the other hand, as member of the ERA-NET[31] PathoGenomis[32] (November 2004).[33]

The GEN-AU Programme Office organizes competitions for project funding: It issues calls, puts in order submissions of project proposals, organizes the evaluation process and administrates the contract negotiations and the funding of projects. It also arranges the annual evaluation conferences.

Together with the ministry, the office is in charge for the announcement of the calls, as well as interactions with the cooperation partners Austria Wirtschaftsservice GmbH (aws), dialog<>gentechnik and Science Communications. aws promotes technology transfer; it screens publications, gives advice on patenting and licensing and supports founders.

Several partners (Programme Office, dialog<>gentechnik, Science Communications) are in charge of public relations work, webpage, folders etc. Also, it organizes Summer Schools and science cafés, as well as discourse days.

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28 One should keep in mind that this is a quite linear picture, too, while the "reality" is far less linear.

29 More information on these project types: section 2.2 and section 3.4

30 In fact, Mag. Elisabeth Tischelmayer is member of the network steering committee of the PathoGenoMics ERA-Net.

31 ERA-NETs are a Coordination Action (CA) supported by the European Commission, with the aims to strengthen the European scientific base and to support the structuring of the European Research Area (ERA).

32 See *http://www.pathogenomics-era.net/*, Feb 12, 2005

33 In the meantime, the ministry is also member of other ERA nets.

We systemized the different effects that are caused by GEN-AU in three different steps: (i) 'Outputs', the technical results of the projects, (ii) 'Outcomes', the direct effects of the projects, and finally, (iii) 'Impact': the wider effects of the programme on the society. "In principle, outputs cause outcomes, and outcomes cause impacts."[34] Outputs of GEN-AU are the different projects, mobility grants, the webpage, discourse days, science café and Summer Schools; outcomes are the increased participation in international programmes, publications, awards, patents, and media reports. Finally, 'new techniques for research and industry', 'improvement of human health' and 'enhanced quality of life' are defined as impacts.

Table 10 focuses on the assessment of the quality of the programme design using a checklist.

What are Outputs, Outcomes, Impacts?[35]

"[…] Outputs: For example, a programme driven by the societal goal of improved health might fund research in infectious diseases. Programme appropriations allow it to purchase labour and materials needed for operations. Short-run programme *outputs* might include publications, presentations, workshops, and test results. Next-stage outputs might include prototype therapies, and prototype vaccines, followed by clinical trials. Longer-term programme **outcomes** might include treatments and vaccines applied by medical establishments. Long-run **impacts** might include reduced rates of disease spread, higher survival rates of those infected, and reduced mortality rates for the nation."

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[34] *Arnold/Guy* (1997, p. 81): Technology Diffusion Programs and the Challenge for Evaluation. OECD. See also *Feller/ Ruegg* (2003).

[35] This explanation is taken from (*Feller/Ruegg* (2003)).

Table 10 A checklist to assess the quality of programme design

	Checklist	Yes	No	Comments
1	A variety of audiences were taken into consideration when specifying goals and effects.	✓		see chapter 3.1, page 2
2	Targeted participants and/or partners are described and quantified.	✓		There were considerations as to what extent research groups in the field exist in Austria. Maybe less effort was put into the quantification of possible industrial partners.
3	Goals are clearly connected to the mission of the programme.	✓		A diverse set of goals connected to the overall mission of the programme has been formulated. The overall aim of the programme is to promote science. Regarding the other goals no clear hierarchy has been set up.
4	Goals are operational.	~		In principle, yes: but there are at least some goals (increase public acceptance, create knowledge to enhance health and protect environment) which do not seem to be operational.
5	Events, flanking measures, services etc., are described clearly and connected to mission and goals.	✓		The flanking measures connected with GEN-AU are clearly described.
6	The intensity of the intervention is appropriate for the type of programme and participant	✓		Compared to other Austrian programmes, especially to other bm:bwk programmes, the amount of money spent is high (e.g. even pilot projects have an average budget of € 720.000, Austrian Science Fund projects have an average budget of € 197.000).
7	The duration of the intervention is appropriate for the type of programme and participants	✓		The programme has a clear end date; this reflects its character as a thematic programme which tries to boost a hot topic.
		~		Networks build up infrastructure which should be available for the whole life time of the programme.
8	Outcomes reflect reasonable, progressive steps that participants can make towards impacts	✓		Outcomes reflect steps towards the intended impacts.
9	Outcomes address awareness, attitudes, perceptions, knowledge, skills and/or behaviour of participants		✓	The outcomes focus on quantifiable indicators such as publications, patents and awards. Only outcomes already achieved have been mentioned in the workshop that resulted in the logic chart.

	Checklist	Yes	No	Comments
10	Outcomes are within the scope of the programme's control or sphere of reasonable influence.	✓		Stated outcomes are mostly within the scope of the programme. Awards like the ones mentioned (i.e. START award, and award of recognition from the state of Lower Austria; see also logic chart Graph 5), however, are not only the outcome of one single programme, but the result of a combination of measures with GEN-AU being one of them.
11	The outcomes and impacts are specific, measurable, action orientated, realistic and timed.	~		Outcomes: yes Impacts: no
12	Outcomes and Impacts are written as change statements.	~		Outcomes: partly Impacts: yes
13	Outcomes are achievable within the funding and reporting periods specified.	✓		
14	Impact is not beyond the scope of the programme to achieve.	~		The programme will contribute to achieving the stated impacts but it will not be sufficient.

Source: W.K. Kellogg Foundation, adopted by Joanneum Research

Comments by the evaluation team

GEN-AU has a clear mission that is connected to a magnitude of goals. At the very beginning of GEN-AU most of these goals have been associated with one instrument, the so-called cooperative projects. Also ELSA projects have been planned from the beginning. During the selection of cooperative projects in the first phase of GEN-AU two additional project types have been created, that is networks and pilot projects. At a later stage, also associated projects came into play. In phase II of GEN-AU there will be separate calls for different project types.

GEN-AU has a broad variety of goals. There should be a discussion about the hierarchy of goals and what this hierarchy means for the activity level and the related allocation of funds.

The role and connection points of ELSA projects have not been defined clearly enough. Therefore, at first glance, ELSA projects do not seem to be clearly connected to the mission and the goals of the programme[36]. We therefore suggest that a more tangible concept of ELSA and its link to GEN-AU be developed and strategically communicated.

Within GEN-AU the promotion of women in leading positions is a goal. Yet there is no specific instrument or activity connected to this goal.

In addition, the chart also shows the aim to promote technology transfer and industry. Especially the aspect of industry linkages is stressed. These linkages have been established in a number of projects, but there are no strong links on the programme management level. Only a minority of the Scientific Advisory Board members are industry representatives.

3.6 Programme Partners

3.6.1 Overview and General Remarks

Being a thematic programme, GEN-AU attempts to foster genome research in Austria not only by funding projects but also by providing service functions to its genome research undertakings. Some of the offered services (the projects that do research themselves and distribute the results to the other projects) are organized as a special type of project, the so-called network projects and have been already discussed in section 3.4.2. Services that are related to public relations (PR) and intellectual property rights (IPR) are provided by separate bodies. Public relations is within the joint responsibility of two organisations, dialog<>gentechnik (dgt) and Science Communications (sc) who collaborate closely with the GEN-AU Programme Office in order to fulfil their tasks. Advice on and service functions related to IPR are the responsibility of tecma, a division of the Austria Wirtschaftsservice GmbH (aws). Finally, a small role has been given to the Deutsches Ressourcenzentrum für Genomforschung (RZPD). The following sections describe these organisations and their tasks and attempt to analyse their performance up to now.

[36] Furthermore, the goals of ELSA projects do not seem to have been clearly communicated. The interviews showed a discrepancy between the views of ELSA and non-ELSA scientists with the latter being convinced that ELSA projects aim at supporting the GEN-AU goal to increase public awareness and acceptance of the topic. ELSA scientists, however, see themselves predominantly as researchers on ethical, legal and social aspects of the topic.

3.6.2 dialog<>gentechnik

The independent society and non-profit organisation dialog<>gentechnik (dgt) was founded in 1997 under the name "Plattform Gentechnik & Wir". Its primary mission is to encourage and support the dialogue with the general public and to facilitate access to information about genetic engineering and related topics. In pursuing these goals, dgt tries to stick as much as possible to scientific principles, which is why it employs a board of active scientists that supervises the activities. All activities are publicly funded.

3.6.3 Science Communications

"Science Communications" (sc) is a privately-owned PR agency (or, put in their own words, an agency for the promotion of science). Set up in 2000, it specialises in public relations for companies and institutions involved in science and research. The agency collaborates closely with partners from research, industry, fund raising bodies, consulting companies and science journalists. It defines its work as providing mediation between science, industry and policy.

3.6.4 Austria Wirtschaftsservice GmbH – aws

Austria Wirtschaftsservice GmbH (aws) is a special bank that is fully owned by the state and operates as a private limited company. It deals with federal funding and consulting of Austrian companies as well as with promoting and imparting of technology and innovation. aws has six divisions that operate a number of support programmes for companies and researchers aimed at fostering innovation, technology transfer between science and industry, intellectual property rights, etc.

Two of these programmes are relevant for GEN-AU: tecma and LISA. Tecma is a programme of the BMWA and supports universities and researchers who want to protect and commercialize their inventions. LISA ("**LI**fe **S**ciences **A**ustria") supports researchers in establishing start-up companies.

3.6.5 Deutsches Ressourcenzentrum für Genomforschung GmbH (RZPD)

RZPD is a service centre for genomics and proteomics research. It provides research material, high throughput technology and automation solutions for academic institutions and for industry. Due to a bilateral agreement between bm:bwk and RZPD, a lower-cost use of resources for GEN-AU researchers has been secured.

3.7 GEN-AU and Public Relations

Over the past decades public support has become more and more important for the scientific community in order to secure funding for research. As a result, professional public relations activities form now an integral part of the daily work of many research institutions and agencies involved in the funding of research throughout the world. With regard to life sciences, the importance of active PR work is specifically stressed in the European Commissions´ strategy paper on life sciences and biotechnology:

"Life sciences and biotechnology have given rise to significant public attention and debate. The Commission welcomes this public debate as a sign of civic responsibility and involvement… Dialogue should be open for all stakeholders. Public authorities should help to ensure participation by stakeholders with limited resources. Economic operators, industry and users, who have economic interests at stake, as well as the scientific community, bear a particular responsibility for active participation. The Commission invites these parties to respond to public concerns, for example, through transparency of their visions, policies and ethical standards."[37]

[37] Commission of the European Communities (2002)

Following its horizontal approach, GEN-AU is the first public research programme in Austria to actively carry out dedicated thematic PR activities on a larger scale. PR activities within GEN-AU include:

- The implementation of a corporate design and its compulsory usage for project participants for and on business cards, letter paper and folders. In addition, the GEN-AU logo is to be used on posters presented at conferences;
- The design and operation of a dedicated GEN-AU webpage that provides information on the GEN-AU projects and programme content but also more general information such as current news related to genome research and/or genetic engineering;
- The operation of an electronic newsletter to which anyone interested can subscribe;
- The handling of communication with the (mass) media, the preparation of press releases and the arrangement of press conferences and interviews (pro-active media work);
- The organisation of so-called “Diskurstage“ (discourse days) which aim at bringing together scientists and the general public and fostering discussions and discourse on topics related to genetic engineering;
- The organisation of so-called “Summer Schools” that allow high school students to get in touch with genome research during their holidays. Throughout Austria, high school students are offered internships in GEN-AU research facilities. As the Summer Schools also aim at promoting young researchers they will be dealt with in more detail in the respective chapter.

In order to make sure that the PR work meets today’s professional standards; the bm:bwk looked for partners with experience in this field. Phase I of the GEN-AU programme saw dialog<>gentechnik in charge of the organisation of the Summer Schools and the discourse days. dgt was also responsible for those parts of the GEN-AU webpage and the newsletter that require scientific know-how and also handled requests linked to genome research. Science Communications, on the other hand, was responsible for all issues related to corporate design, the design and the operation of the GEN-AU homepage and the graphical realization of folders, posters etc..

In practice, however, division of work does not seem to have worked out well. Several interview partners argued that the distribution of responsibilities between Science Communications and dialog<>gentechnik was not clear to them and pointed out that this complicated public relations work. This has been confirmed by one of the organizations involved in PR work. Both Science Communications and dialog<>gentechnik stressed, nonetheless, that advancements have been made by defining areas of responsibility over time and that their working relationship is much better now.

The actual implementation of the PR strategy (which focuses mainly on the general, albeit scientifically interested and literate, public) has met considerable criticism. While generally underlining the importance of good PR work and commending the fact that a research programme offers dedicated PR activities in Austria, complaints of interviewees were common and circled mostly around the following issues:

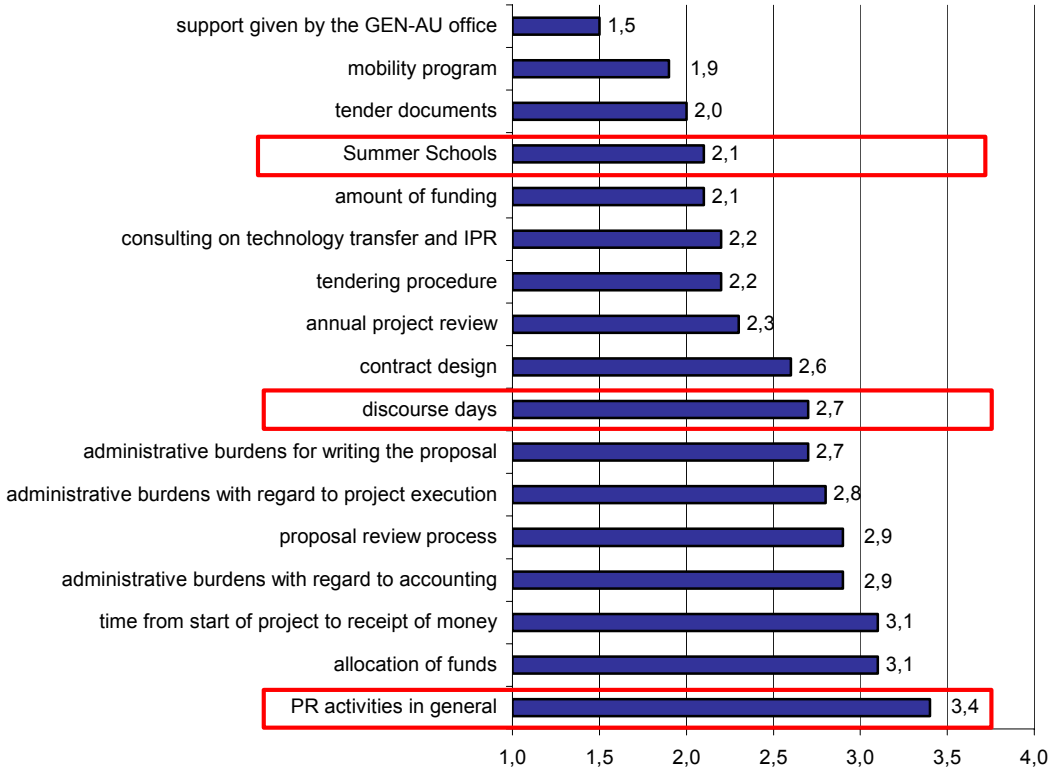
- **Exaggerated usage of corporate design**: Many project participants (project leaders, managers and involved post-docs alike) thought that GEN-AU corporate documents are used too excessively, thus creating some sort of administrative burden. Problems occur especially in borderline cases where it is not clear whether one should use, for example, the companies´ or university's business cards or the GEN-AU business cards. The same is supposed to hold true for the letter paper. In some cases, usage of GEN-AU corporate documents is in direct violation with company or university regulations. Finally, some also complained about being asked how much letter paper and business cards they would need (and, hence, order) for the three years following the start of the projects – a figure that is supposedly hard to estimate.
- **Lack of visibility of GEN-AU in the general public:** The majority of the scientists interviewed (those working for a GEN-AU project as well as outside experts) argue that GEN-AU is not visible to and thus hardly known by persons outside of the programme – at least not to the extent that they regard as desirable. Some interview partners specifically mentioned the case of the Austrian physicist Anton Zeilinger, who is believed to be much more familiar to the general public in Austria than any single project of GEN-AU or even GEN-AU as a collective brand.
- **Little usage of newsletters**: Outside scientists and experts were also disappointed by the fact that – after they had learned about GEN-AU and signed up for the electronic newsletter – they hardly received any information on the programme.
- **Areas of responsibility of dialog<>gentechnik as opposed to Science Communications**.
- **The opinions on the homepage vary a lot:** While some like the professional appearance of the homepage and had no problems using it, others found the web site to be too cluttered with information and too businesslike, especially if the general public is taken into account as one major target group. Almost all agreed that a special section be devoted to high school students with a more upbeat design.
- **Opinions on the discourse days are also mixed:** Almost every interviewee stated that discourse days would be, in general, a good thing. Some believe, however, that discourse days, especially if not properly advertised or if organized at a rather remote venue, would not see an adequate number of people attending it. Other interviewees liked the fact that not every discourse day would take place in Vienna (thus fostering science also in other places than the capital) and/or suggested that a more secluded venue would attract fewer, but more interested people.

On the positive side, the interviewees appreciated the professional look of the corporate documents and the fact that employees of Science Communications were always at pains to do their job properly. Positive statements were also given on the Summer Schools that were mostly considered to be a success.[38]

Graph 6 displays the satisfaction levels of the programme participants with different aspects of GEN-AU, as obtained from the online survey. Respondents were asked to grade their satisfaction with these aspects using Austrian school grades (which correspond basically to the American system, with a 1 denoting an A grading, a 2 denoting a B grading, etc.). The results from the online survey completely back up the findings from the interviews: With an average grade of 3.4, PR activities as a whole were deemed to be the weakest aspect of the GEN-AU scheme. Some aspects that relate to PR performed better, however. The discourse days were on average rated at 2.7, and the Summer Schools received an average grade of 2.1. The Summer Schools were thus ranked third in comparison to all other scrutinized aspects of GEN-AU. Looking at the overall picture, however, it seems that PR activities need to be polished.

[38] Summer Schools will be discussed in more detail in section 6.3.1

Graph 6 Satisfaction with different aspects of the GEN-AU programme, average values *)



*) scale: 1=very satisfied (A), 2=satisfied (B), 3= averagely satisfied (C), 4=rather unsatisfied (D), 5=not at all satisfied (F)

N=29-39, depending on aspect rated

Source: Austrian Institute for SME Research

3.8 Intellectual Property Rights (IPR) and Commercialisation of Results

One of the main goals of GEN-AU is to make use of the economic potential of obtained research results. In order to support the transition of research results out of the laboratory into the market, the GEN-AU team draws on the services of aws/tecma.

aws´s services for phase I of GEN-AU comprised the following:

- **Implementation of a notification and pre-screening system:** All articles and documents that were/are about to be published have to be sent to aws for pre-screening. Activities related to patenting have to be reported, too.
- **Training and Awareness measures:** aws provided content related to IPR and technology transfer for the GEN-AU homepage and the GEN-AU folders. aws also organized a number of workshops for GEN-AU participants. The topics covered included project management and IPR issues.
- **Set-up of a patent coordination team**: Due to lack of experience with technology transfer in the life sciences in Austria at the time GEN-AU was designed, aws had some difficulties finding qualified persons for contemplating IPR issues in genome research. Eventually, a team consisting of eight experts, mainly from Germany and Switzerland, has been set up to form a patent coordination team.

- **Support in Contract Design:** aws wrote the sections in the consortia agreements that deal with IPR and created templates for forms that deal with technology transfer (e.g., inventors´ agreement, invention disclosure form etc.). Contracts (such as license agreements) set up by contracting parties (one of which had to be a GEN-AU beneficiary) were – upon request – reviewed. Support was also offered for contract conclusions.
- **Public Relations:** aws advertised GEN-AU in presentations given at national and international workshops.
- **Adoption of an internal project database.**

Special arrangements have been made with GEN-AU beneficiaries/projects with strong industry ties (that is, in particular, Boehringer Ingelheim Austria/IMP). Under these agreements, Boehringer Ingelheim Austria takes care of IPR issues related to their own projects by itself. However, the company agreed to notify aws of any imminent patent application.

Up until Oct 31, 2004, 132 publications were pre-screened (including posters, abstracts, papers and scripts), 9 patent applications reviewed and 2 license agreements examined.

Satisfaction with aws services is, generally speaking, high as also indicated by the average rating of 2.1 (on a scale from1=very satisfied to 4=not at all satisfied; see also Graph 6). As a matter of fact, however, few patent applications have seen the light of day and thus only a limited number of people stay in close contact with aws. Some research teams – not only the Boehringer groups – revert to services and counselling from other organisations when it comes to IPR (such as private consultants). The overall impression is that aws is only loosely involved with GEN-AU, despite a claimed reporting frequency in the pre-screening process of about 70 %. Nonetheless, involvement of aws is likely to grow as soon as further results are obtained. In this context it is also noteworthy that several outside experts stressed the overall need for an increase of know-how in the life sciences community concerning IPR.

Comments of the Evaluation Team

GEN-AU, being a horizontal programme, makes use of a network of partners to primarily carry out tasks related to public relations and to the support and consulting on matters of technology transfer and IPR. The choice to have professional partnering institutions handle these jobs was welcomed by practically all interview partners and is also reiterated by the evaluation team. The organizations seem to be well chosen, as each one of them has good experience and reputation in its field of work. In general, we believe that the partner network forms (and should form) an important part of GEN-AU.

As regards public relations, however, it is also clear that the results of the activities have fallen short of the (high) expectations. This seems to be mainly due to the fact that some friction existed between the involved partners (Programme Office, sc and dgt) which in turn resulted in unclear distribution of responsibilities. Nevertheless, parts of the public relations strategy seem to have worked out quite well (e.g., GEN-AU corporate design and Summer Schools) which might indicate that the project participants´ expectations could have been set too high. One has to bear two things in mind: First, GEN-AU's thematic setting may not be, as some interview partners suggested, as easily transportable to the general public as, for example, the "beaming" experiments by Mr. Zeilinger, especially given the high scepticism present in Austria on matters related to genetic engineering. Secondly, GEN-AU is the first support programme in Austria to actively pursue a public relations strategy and experience still needs to be built up.

To conclude, some adjustments seem to be necessary. We recommend that

• competencies and areas of responsibilities be better distributed among sc, dgt and the Programme Office with clear hierarchies and a single point of contact for project participants;

• the functionality of the newsletter be checked, as several interested people did not receive ample information; this contrasts with statements in the annual reports on PR activities on the number of newsletters dispatched;

• the current usage of the GEN-AU corporate documents be reconsidered; maybe it should suffice if only larger projects that provide services to other GEN-AU projects (the networks) use the documents more extensively, while the smaller projects should be allowed to chose more freely when and if to use the corporate design;

• the homepage be in parts redesigned and a section for high school students with a more upbeat design be included;

• the English parts of the homepage be updated more frequently;

Only few things can be said about aws and its supporting role concerning IPR. Satisfaction levels of those who make use of the offer are relatively high. Some of the projects revert more to other, mainly in-house, organizations for consulting and support on IPR which is perfectly okay as long as the proclaimed information flows work.

3.9 GEN-AU in the Austrian Research and Technology Policy Environment

We can distinguish between different strategies in doing thematic priority setting: a government can try to "boost" the functional parameters of a national innovation system (e.g., the educational system), it can try to focus on societal challenges ("aging" and "health") or it can concentrate on scientific and technological priorities (like "nanotechnology")[39]. GEN-AU has

[39] *Dachs et al.*(2003)

elements of all of these strategies as genomics (as a part of life sciences) may be of relevance for a broad set of areas. Due to these potential broad effects, it is essential for a national economy to build up competences in this field. Thematic programmes are also used by other nations to strengthen their position in genomics and related areas. For details on other nation's strategies see chapter 8.

Nevertheless, it is not evident that a national innovation system (NIS) must have a thematic programme in this particular area. No due diligence has been carried out when establishing GEN-AU: The potential benefits of a thematic programme in genomics have not been compared with potential benefits of thematic programmes in other areas of research. (Such approaches have not been taken in Austria at all up to now).

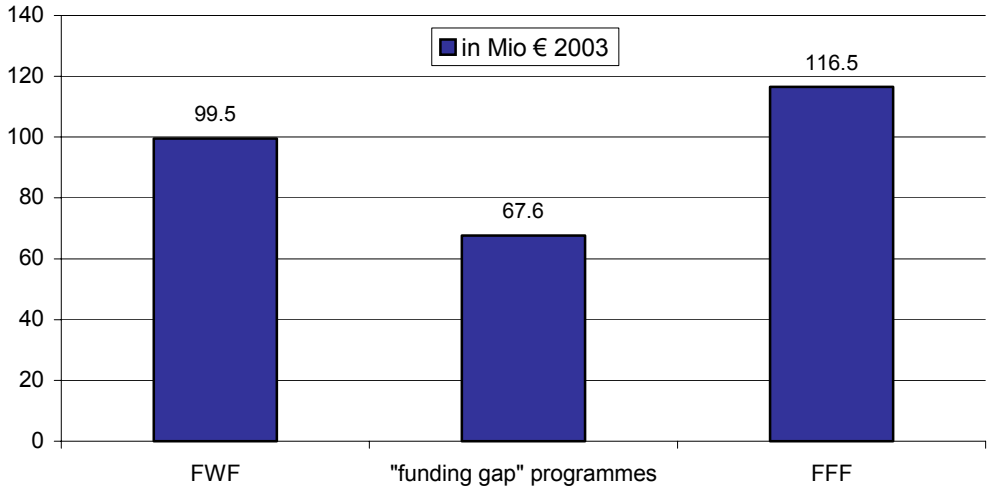
Yet, GEN-AU fits into an overall Austrian policy concept: The Austrian Council for Research and Technology Development gives strategic advice to the Austrian government and has introduced its National Research and Innovation Plan[40] to set the 'landmarks' for Austria's National Innovation System (NIS). Genome research is one of the thematic priorities.

3.9.1 The Role of Thematic Programmes in Austria's Research and Technology Policy

In the last few years, Austria's policy makers (in all relevant ministries) seemed to be strongly influenced by one guiding principle: fighting the 'funding gap' between (basic) research on the one hand and industry on the other. We saw the development of new instruments to foster science industry linkages: competence centres (e.g., Kplus) with a strong institutional background, project funding schemes with compulsory cooperation of both sides (FIT-IT), and so called 'bridge – projects': "translational" research (Austrian Science Fund) and 'Brückenschlag' (FFG). Enormous amounts of money go into this type of funding. As shown in Graph 7 the Austrian Science Fund spent about € 100 million on basic research in 2003; the Austrian Industrial Research Promotion Fund FFF (now part of the FFG) spent about € 117 million. Funding gap programmes like Kplus and FIT-IT had a budget of € 68 million. Initially, GEN-AU was planned as a Public Private Partnership and also aimed at overcoming the funding gap.

[40] *Rat für Forschung und Technologieentwicklung* (2002a)

Graph 7 Is there a "funding gap" in Austria?



Source: Zinöcker 2005

In 2005, the allocation of resources will shift in support of the 'funding gap programmes' as this year 'bridge projects' will start. Although the promotion of science and industry linkages is an important function of government funded R&D programmes, policy makers must not forget 'classical' tasks, especially in the field of basic research.

Comments of the Evaluation Team

Thematic Setting: We think that a thematic programme like GEN-AU is legitimate, although we would prefer policy to select topics for thematic programmes after a comparison with other possible candidates.

'Basic Research' or 'Bridges'? We think that the distribution of budget that is shown in Graph 7 represents a certain imbalance in the overall Austrian research and technology development programme portfolio. Without any doubt the promotion of science industry linkages is an important task. However, it is not the only factor that needs to be addressed to stimulate a national innovation system. Therefore, one might get the impression that the present concentration on 'funding gap' programmes reflects something of a policy fad, whereas the pillars on the left and right side seem to be "poor cousins". We pointed out above that GEN-AU started as a Public Private Partnership. For several reasons that are presented elsewhere the programme got another spin: Technology transfer is still an issue, but projects predominantly focus on research quality. From the national programme portfolio point of view, this redefinition was the right decision.

3.9.2 Why Fostering Collaboration and Network Development is an Important Feature of GEN-AU

Innovations generally arise through a recombination of existing knowledge plus new knowledge from research. Due to the complexity of the modern world, individuals only hold a small portion of (highly specialised) knowledge, whereas innovative activities require the interaction and inter/exchange with others. Small firms in particular lack sufficiently large knowledge bases to create innovation themselves. Networks[41] can make an important contribution by combining skills, promoting knowledge exchange and thereby fostering innovative activities.

The combination of skills and knowledge through networking leads to a greater common stock of knowledge which can stimulate learning processes and can facilitate the development of new innovative approaches. Research and innovation networks bring together researchers with different backgrounds (from science and industry) and sometimes also across different disciplines. The greater variety of knowledge increases the amount of theories and concepts available out of which new solution concepts can be designed. Furthermore, the community aspect of research networks can be stimulating and motivating for productivity.

The increased proximity of players in a network does not only facilitate the exchange of explicit knowledge, but also the exchange of tacit knowledge, i.e., knowledge that is not formally written down, but instead is embedded in people as experience and know-how. The exchange of tacit knowledge can be particularly conducive to innovative activities.

Networks increase the visibility of researchers and firms as well as of their research results and innovations. Network infrastructure can contribute to making the diffusion process easier. Reaching critical mass through a network is also helpful for establishing and signalling national presence in a topic.

Despite the ability of networks to stimulate the quality and quantity of research and innovation, research networks also have drawbacks. Participation in a network requires considerable planning and coordination efforts (often due to formal bureaucratic requirements) reducing the amount of resources available for actual research. In most publicly funded research networks, a detailed description of the planned research projects is mandatory, which can limit the radicalism of the approach. Furthermore, junior researchers feel that formal networks can be harmful for establishing their researcher identity, because of the possible disadvantages associated with sharing ideas and results with established researchers.[42]

Comments of the Evaluation Team

Although the drawbacks resulting from research networks are not negligible, we are convinced that innovation and network theory provides us with a whole set of arguments that justify the 'network principle' within GEN-AU. Moreover, we could not find evidence (especially with the SNA) that supports a recommendation to cancel this principle.

[41] One should not confuse the term 'networks' that is used in this section (which is about collaboration) with networks that arise from collaboration with the specific instrument used by GEN-AU called network projects.

[42] *Schatz* (2003)

3.10 Daily Activities within GEN-AU

3.10.1 Management by the GEN-AU Programme Office

The GEN-AU management team is part of the ministry staff, but not on a legal and official basis: GEN-AU Programme Office employees are a in effect "temps"(contracted employees), who have in principle a formal contract with the ÖGGGT (Austrian Association for Genetics and Genetic) Engineering[43], but are under supervision of the ministry.

The interviewees attested that the Programme Office performs well; that the managers are "enthusiastic" and show "extraordinary dedication to their job". This is, as can be seen in Graph 6, also reflected in the results of the online survey. Nevertheless, as temps, the programme management "suffers" from a whole set of problems, which affect its work negatively:

- The management team is not allowed to use the ministry's newly set up electronic folder system ("Elektronischer Akt"). However, as a part of the ministry, all processes in GEN-AU have to be documented in this system, so the management team faces severe problems in following its own processes.

- The management team had to follow the ministry's guidelines on how to carry out financial controlling of projects. These guidelines could be characterized as old fashioned and quite formal. (One needs to show and keep invoices in original, open your own account, etc.) The management team and the ministry staff in charge for GEN-AU do not have the competences to reform these guidelines. The situation has, however, improved recently (e.g., no more invoices in original needed)

So, inflexibility and bureaucratic burdens negatively affect the success of the programme. However, there are some reasons why the ministry wants as much influence as possible on its programme, and, therefore chooses administrative solutions like those used in GEN-AU: (i) GEN-AU spends public money - it is clear that this spending process should be done according to special processes; (ii) the in-house management of programmes guarantees a direct feedback to all policy makers in the bm:bwk; and finally (iii) GEN-AU wants to yield not only excellent research, but also has a whole set of other goals ("women", "labour", "education"). Therefore, it is not enough to build up management capacities in the core mission. For example, the programme needs the capability of organizing Summer Schools for high school students, discourse days. There is no clear candidate in Austria's landscape of agencies that is able to provide all of these needed competences.

Nevertheless, the evaluation team is convinced that the organisational model which was chosen within GEN-AU needs considerable improvements: In Austria, there was and is an overall government policy that ministry staff must be reduced. This policy is followed quite strictly, but has some annoying effects on how work is organized in the ministry and, much more important, on the work load of the ministry staff. So the ministry staff will, as a matter of fact, have to concentrate on core competences. This core competence is clearly not the administration of technology and research programmes; rather, it is on the policy and strategic level. Moreover, there are several agencies in Austria that are specialised on the management of research and technology programmes: FFG and FWF have considerable competences in setting up and managing procedures as needed in GEN-AU. However, the know-how created in the GEN-AU office should not be lost and the special needs of GEN-AU need to be taken into consideration when changes in the management of GEN-AU are considered.

[43] http://www.oegggt.at/, Apr 12, 2005

3.10.2 Overheads

Table 11 shows the overheads resulting from running research programmes in a number of countries, expressed as a percentage of total funding volume. GEN-AU overheads (6.4%) include costs for the GEN-AU office, costs for the project reviews and assessments, costs for activities related to public relations and public awareness and, finally, the costs for the services of aws. Without PR costs, GEN-AU overheads in phase I would amount to only 2.3 % of the total funding volume.

When considering these figures it needs, however, to be noted that GEN-AU is not required to pay fees for using the infrastructure of the ministry (office rooms, computers, telephone, etc.). Corresponding imputed costs are not included in the overhead shares.

Table 11 Overheads - percentage of total funding volume

Overheads	Programme / Organization	
6.4%*	GEN-AU phase I	Austrian Genome Research Programme (Costs for educational and awareness activities included)
3.3%	FFF (2002)	Austrian Industrial Research Promotion Fund
~ 3.0%	FWF (2002)	Austrian Science Fund
5.0%**	FFG	Austrian Research Promotion Agency
3.6%	DFG	German Research Foundation
5.0%	BBSRC	The Biotechnology and Biological Sciences Research Council (UK)
5.3%	EPSRC	The Engineering and Physical Sciences Research Council (UK)
5.4%	ESRC	The Economic and Social Research Council (UK)
3.5%	MRC	The Medical Research Council (UK)
4.3%	FWO Vlaanderen	Fund for Scientific Research - Flanders (Belgium)
7.3%	NOW	Netherlands Organization for Scientific Research
7.7%	Vetenskapsradet	Swedish Research Council (8% outsourced tasks included)
5.0%	RCN	The Research Council of Norway

* Office and evaluation costs: 2.3 % only (no fee payed for ministry infrastructure)

**Target value of FFG

Sources: GEN-AU, Evaluation of FWF and FFF (*Leonhard, Jörg, Falk, Rahel* 2004; *Van der Meulen, Barend* 2004)
Press conference of FFG; adapted by Joanneum Research

Comments by the evaluation team

GEN-AU is an ambitious programme with a whole set of goals that demand a highly committed management team, but also dedicated programme partners. Considering these points, we think that the overheads for the GEN-AU programme are low. We do not think that extremely low levels of overheads should be a goal for actively managed programmes like this; policy should accept that programmes addressing a large variety of goals like GEN-AU cause more costs than initiatives focusing on a small number of goals and have a higher amount of routine, e.g., the research projects managed by FWF.

3.10.3 Satisfaction with Different Aspects of Day-to-Day Management Activities

Project leaders are, on average, not very satisfied with the amount of administrative work that comes with the execution of GEN-AU projects (see Graph 6). Administrative burdens regarding accounting (average rating: 2.8 on a scale from 1=very satisfied to 5=not at all satisfied) and project execution in general (rating: 2.6) are perceived to be rather high. One has to keep in mind though that the projects are very large which requires stricter procedures to be in place. An issue is certainly the time from start of the project to receipt of the funds which was graded very unsatisfactorily. Given the stricter rules it seems necessary to provide for adequate and competent support by the GEN-AU Programme Office. The average satisfaction level for GEN-AU Programme Office (1.4) is the highest among all rated aspects of GEN-AU and indicates the highest level of satisfaction of project leaders with the office.

4 Networks and Networking within GEN-AU

4.1 Introduction

A major goal of GEN-AU is the promotion of networking and the exchange of research-related information and resources between the scientists involved in the GEN-AU project; at the same time the programme itself intends to develop better networking ties between Austrian genome research and its domestic and foreign partners in science and industry.[44] By embracing these goals, the GEN-AU programme recognises the value of the viewpoint common in innovation research that in knowledge and research-intensive milieus the networking of actors plays a significant role in determining the outcome of research activities.[45] For such reason the promotion of networking between individual research scientists and research organisations has become a standard feature in political programmes with bearing on the field.[46]

A good two years after the start-up of the GEN-AU programme it is therefore of considerable interest to see to what extent an exchange of research-related information and resources has been established between the scientists involved in the GEN-AU- programme. To provide an answer to this question, the following study uses the proven methods of social network analysis (SNA) to examine relationships between the cast of actors in the GEN-AU programme, differentiating it into two primary dimensions:

- the dimension of social exchange understood as communicative relationships (section 4.1.1), and
- the dimension of exchange of resources relevant to research (section 4.1.2).

This distinction is based on the tenet germane to SNA that social relationships are or can be multidimensional (multiplex) and that it is their very multiplexity – the interlocking and mutual support afforded by pertinent and personal relationships – that makes for the stability and functionality of networking relationships, and thus for their success. From this perspective a network is chiefly constituted by the material exchange relationships existing between actors. These relationships are described as "networking" when they are characterised not only by an exchange of research-relevant resources (i.e. data, material or personnel) but also by their being embedded in a web of communicative relationships.[47] Thus this approach enables us to gain a first impression of the structure and scope of networking relationships between the cast of actors involved in the GEN-AU programme.

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[44] The Austrian Genome Research Programme should serve *"... national and international networking of university and extra-mural research capacities. "* See the statement on the GEN-AU homepage of 5 April 2005. A similar view is also given in the "Directives for the Austrian Genome Research Programme GEN-AU" of September 22, 2002: *"The structural goal is the creation, maintenance, enhancement and networking of research potentials attractive to national and international science and industry."*

[45] In such contexts networking can also function as a kind of insurance, hedging actors involved in the "production of the new" against the latent danger of non-remunerated third-party use of knowledge whilst simultaneously enabling the realisation of network partner learning processes and of potential burden sharing in view of the not inconsiderable risks of failure associated with cutting-edge research. See *Ahuja* (2000); *Bianchi/Bellini* (1991); *DeBresson/Amesse* (1991); *Powell et al.* (1999)

[46] As cooperation and communicative relationships play an ever greater role in innovation processes (see inter *alios Bührer/Peter* 1999), "*policy-making in research, technology and innovation [is] increasingly focused on the development of innovation networks, competence centers and competence networks etc. What such initiatives share in common is that they are all not exclusively focused on the realisation of a narrowly defined research or technological objective, but rather more generally concerned in driving forward structural and behavioural transformation in the stakeholder institutions themselves."* (*Bührer*/*Görisch* 2003, p.203)

[47] Furthermore, the very nature of dyadic relationships prevents them from becoming networking relationships which always involve a cast of at least three actors.

- Once these matters have been addressed, there remains the key question as to what role is played by both relationships between the cast of actors within the GEN-AU programme and by contacts with actors extraneous to the programme in terms of their contributions to the successful outcome of research activities and the accompanying project management programme (4.1.3).

- Based on these individual steps, a first evaluation may be made of the nature and design of the relationships and networking within the GEN-AU project (4.1.4).[48]

Response Rates and Limitations of the SNA

It should also be noted that all the presentations of relationships and GEN-AU internal networking structures that follow are solely based on data gathered from actors responding to the online survey. With a response rate of around 52 % this means that while obviously a full and comprehensive picture cannot be given, a representative sample of exchange relationships between the GEN-AU cast of actors is nevertheless still possible. This can be said in particular for the relationships of network projects and co-operative projects with a response rate from heads of projects of 89 % and 63 % respectively, and to a certain extent for associated projects (overall response rate of 60 %). The significantly lower participation rate among pilot- and ELSA projects (response rates of 32 % and 40 %, respectively) means that we have comparatively little available data concerning their relationships. This should be borne in mind when considering the presentation of relationship structures that follows.[49]

It is also important to note in this context that for a number of projects whose managers did not participate in the survey we have data on their relationship furnished by their exchange partner. This is always the case when relationships exist between a project respondent to our survey and a "non-respondent" project and where at least one of the respondent partners has given us data on its nature and structure. In terms of the enquiry we are pursuing – the degree of embeddedness in the exchange of resources or GEN-AU internal communicative relationships – this quasi passive participation in the survey at least allows us to formulate a discreet estimate of the degree of integration achieved by "non-respondents".

4.1.1 Communication Networks

In network and innovation research there is a broad consensus that complex communication systems are needed in order to reduce the level of uncertainty attendant on innovation processes and to limit the risks of opportunistic behaviour.[50] Advocates of this view claim that social embeddedness of actors and high levels of communication serve both to attenuate the critical problems of non-remunerated third-party use of knowledge which constantly afflict knowledge-based and innovation–oriented milieus, and to limit the serious risks of failure inherent to any cutting-edge research project and thus minimise the risk of bad investment. Accordingly, a form of communication which at first glance might seem non-functional or redundant can serve as an indicator of co-operative relationships based on mutual trust and confidence which nurture learning processes and support the efforts of actors – particularly critical for top-level research - to reduce external effects.[51]

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[48] The SNA also sought to identify the actors in the GEN-AU programme that could be classified as "key players" occupying a strategic position with in a network. Findings are presented in section 5.7 of the present report.

[49] For details of the online survey and an in-depth overview of respondents, see the presentation in Appendix 12.1.

[50] See *Ahuja* (2000); *Bianchi/Bellini* (1991); *DeBresson/Amesse* (1991); *Powell et al.* (1999).

[51] In abstract terms: networking enables actors to better co-ordinate their actions with one another and thus to increase the chances that the outcome intended by participants will actually occur. Such behaviour implies a higher degree of reflexivity as it involves not merely a relatively clear definition of one's own expectations but also more precise calculation – and better communication – of "third party" expectations as well.

Following this line of reasoning, we have also used the SNA approach to the GEN-AU programme to assess whether in fact such a communication system has been established within the GEN-AU, and if so, to what extent such communicative relationships could suggest the existence of a system of networking between the cast of actors involved in the programme. This approach was focused on determining the existence of interrelations between actors together with their frequency and transactional content.

The thesis´ message is also that communication-intensive relationships frequently display a relatively broad spectrum of transactional content. This may be evidenced by the fact that exchange relationships in research-intensive contexts require on-going organisational co-ordination and a correspondingly high level of communication whilst, by their very nature, communicative relationships in such contexts exhibit a rich and varied range of content as cutting-edge research activities frequently call for communication going way beyond the immediate scope of the daily agenda. At the same time, however, it should be noted that the substantive richness and intensity of communication can figure in a substitutional relationship because, particularly in professional circles, a certain level of communicative efficiency may be achieved by using the shorthand of jargon – whereby the more standardised and familiar the transactional content is "the less words need to be used". As in the context we are now dealing with it is not at all clear whether the frequency and substantive richness of research-related communication stands in a complementary or substitutional relationship or is in fact a "hybrid" of both types, the following indicator for differentiating levels of communication has been adopted: a *high* level of communication means that actors within the GEN-AU either communicate with each other frequently, at least once a week, *or* engage in a wide range of substantive communication going beyond communication of immediate GEN-AU-related concerns.[52] A *very high* level of communication is displayed when actors communicate with each other very frequently, at least once a week, *and* communicate on a wide range of transactional content.[53] We shall speak of an intensive, close communicative relationship when the relationship is characterised by a high or very high level of communication (see Table 12).

Table 12 Indicators for communication levels

Level of communication	Frequency of communication	Logical operator	Topics discussed
Very high, if…	at least once a week	AND	topics not directly related to genome research, i.e. political, cultural, social or private concerns
High, if…	at least once a week	OR	topics not directly related to genome research, i.e. political, cultural, social or private concerns
Medium/low, if…	less than once a week	OR	task-related communication

Source: Austrian Institute for SME Research

[52] In this sense such communication treating topics lying outside the GEN-AU programme context may be taken as indicating a "rooted" and more confidence-based type of relationship which in turn, is an important prerequisite for limiting external effects inherent in innovation processes and for initiating shared learning processes.

[53] The survey also enquired into a second indicator of communication intensity: duration of communication. Test persons were asked to estimate the average time actors spent in communicating with their six key contact persons. The data furnished is too rudimentary to allow for any further treatment of this aspect here. Such an omission could be significant as it cannot be excluded a priori that frequency and duration of communication also stand in an inverse relationship to one another.

This matrix for measuring levels of communication[54] gives the following classification of communication structures between the cast of actors (shown in Graph 7 as a network structure).[55]

- A high level of communication is particularly characteristic for communicative relationships involving co-operative and network projects. In relation to the subprojects of co-operative project VP3 and their co-ordinators, for instance, a total of 22 communicative relationships could be identified as having an intense (high or very high) level of communication in the sense described above. A lesser number of intensive communicative relationships were also found in the network projects NP1 and NP2 and the co-operative project VP1: In each of these projects 10 heads of projects indicated intensive communication with actors in this project cluster (10 indegrees).[56] Likewise the communicative relationships pertaining to co-operative project VP4 and pilot projects PP4 and PP5 can also be characterised as relatively intensive (5 - 7 indegrees).

- It should be mentioned in this context that these kinds of intensive communication relations are indeed paramount but by no means confined to subprojects found in a "project cluster" sharing a common theme. Rather, it is apparent that quite a substantial level of communication takes place on a "cross-cluster" basis between heads of project of the various project clusters.[57]

- It is also within and between these central project clusters that the main part of those communication relations characterised by a very high level of communication are located, i.e. relationships involving a very high degree of frequency, at least once a week *and* covering a wide range of content.[58] A number of such very intensive relationships are also to be found at the cross-cluster level.[59]

- Whilst associated projects AP2 and AP3 evidently maintain intensive communicative relationships to other projects[60], no such connection has been found with regard to associated project AP1.

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54 It is important to note here that the Report only covers communicative relationships on the management level. An analysis of information exchange on the research worker or scientific officer level, which plays such a vital role in research processes, cannot be conducted here due to insufficient feedback from this group of actors.

55 For the sake of greater clarity the following remarks and in particular the graph do not account for sporadic communication (twice a month or less).

56 In network analysis the "degree" is taken to indicate the degree of embeddedness an actor displays in a particular network. Actors with a high degree are involved in numerous relationships within a network. Indegrees indicate the number of relationships targeted at a particular actor (A), emanating from other actors (x) while outdegrees show the number of relationships a particular actor (A) himself maintains. These indicators can be – but must not necessarily be – identical. In asymmetrical relationships influenced by power relations, for instance, the relationship to a powerful actor (A) can be important for other actors (x) so that a high value of indegrees emanate whereas relationships to other actors (x) can be unimportant for the powerful actor (A) so that he shows no outdegrees. The present report evaluates data on communicative relationships in terms of indegrees.

57 This is particularly noticeable with regard to co-operative project VP2, the two network projects NP1 and NP2, and pilot project PP5. Co-operative project VP2 displays 8 "cluster-external" indegrees, network project NP1 shows 7 indegrees, and network project NP2 and pilot project PP56 indegrees respectively.

58 This type of intensive communication, for instance, is typical for project cluster VP3 and is to a lesser extent present in the other project clusters (VP1, VP2 and PP4 each displaying a single very intensive communicative relationship). In the presentation (see Graph 8) these cases are marked in bold.

59 Between co-ordinators of co-operative projects VP2 and VP3, associated project AP3 and pilot project PP5, the subproject leader of network sub project NPS2a and the coordinator of network project NP, the coordinator of co-operative project VP4, the head of network sub project NPS1c and the co-ordinator of co-operative project VP2, the head of co-operative subproject VSP1a and the co-ordinator of pilot project PP4.

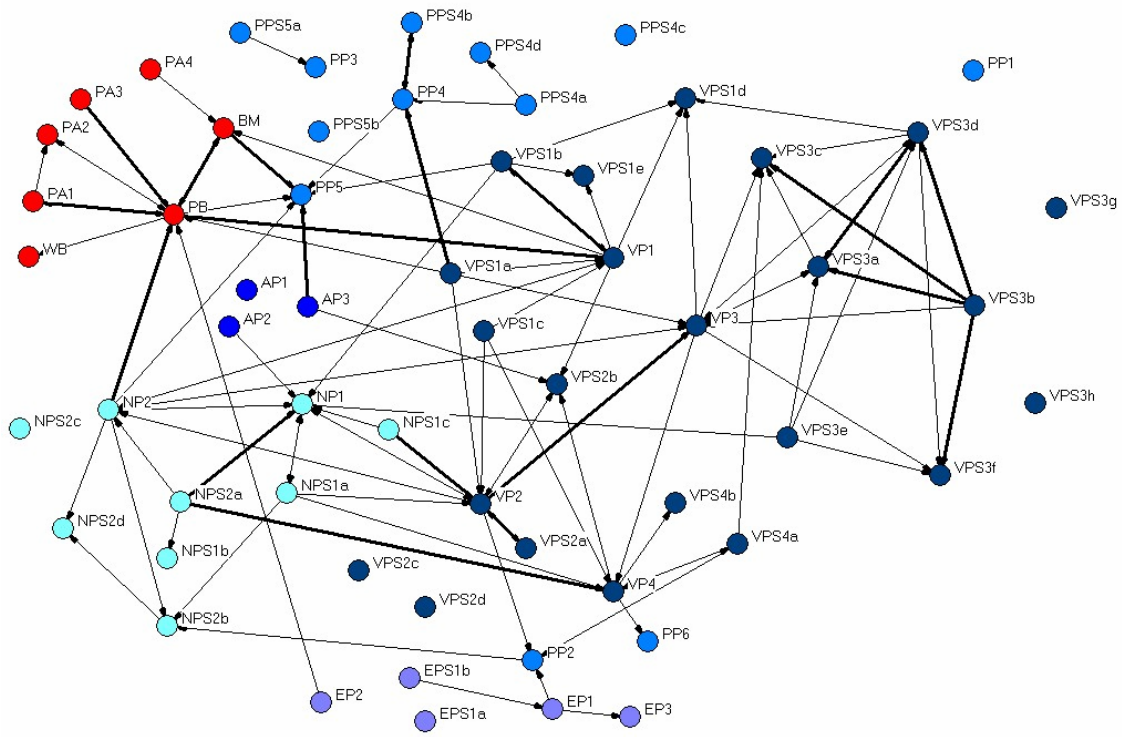
60 AP3 maintains a very intensive communicative relationship to pilot project PP5 and an intensive communicative relationship to the head of subproject VPS2b (outdegree = 2), AP2 has an intensive communicative relationship with NP1 (outdegree = 1).

- In terms of the indictor it is evident that pilot projects PP3 and PP6 and the two ELSA projects for which we have data are comparatively weakly bound to this communication system (all with an indegree value of 1).

- At the management level, the programme office in particular displays a high or very high level of communication[61]; given the interface function of this office, however, this result is not surprising. The Ministry as the central management instance for the overall GEN-AU programme is also characterised by a high level of communicative relationships.[62]

In short, a pattern emerges of intensive communicative relationships between the cast of actors involved in the GEN-AU programme[63] It is particularly striking that the actors involved in co-operative projects and network projects maintain an intensive exchange of information. This observation holds true not just for communication between the various thematically related project groups or actors involved in particular project clusters which are in the main subprojects closely related by their topical focus; it applies equally to cross-cluster communication as well.

Graph 8 Communication flows within GEN-AU



Remarks:

(1) Lines represent relationships with a high or very high level of communication. Single lines represent a high degree of communication (at least one a week or a wide spectrum of transactional content). Bold lines represent a very high level of communication (at least once a week and a wide spectrum of transactional content). The direction of the arrow heads indicates who is the "sender" and who the "receiver" in the relationship.

(2) For the explanation of the abbreviations see the description in Appendix 12.3.

Source: Austrian Institute for SME Research

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61 Apart from programme partners and the ministry, cooperative project VP1, network project NP2 and ELSA project EP2 also maintain intensive communicative relationships with the Programme Office.

62 At least three actors indicate that they maintain intensive communicative relationships with the Ministry. With regard to partner programmes, PA2 displays two and PA1 one single intensive communicative relationship.

63 Furthermore, this report confirms the finding of other studies on networking relationships, namely that a high degree of factor specificity with regard to the creation of transactions typically goes together with a high degree of effort put into communication (see *Bleicher et al.* 2003, p.135).

4.1.2 Functional Net – „Exchange of Resources“

Using the SNA it is also possible to determine to what extent resources and information (be it research or project related) that are relevant for the functioning of the GEN-AU programme are being exchanged between the different projects. The project leaders were thus asked first to state with which other projects they had exchanged relevant resources and, secondly, they had to describe the nature of this exchange. A differentiation was made between the transfer of

- information that is directly related to research and thus of immediate thematic relevance for working activities within the projects;
- materiel;
- personnel, meaning the exchange of scientific staff;

Based on the responses it is possible to reconstruct the functional relations between all players that are important for meeting the goals of the GEN-AU programme and thus contribute to the functioning of the overall net. Graph 9 shows these functional relationships in a network structure.

In particular, the following observations can be made:

- **Clusters around the cooperative projects as well as the network projects are particularly involved with the exchange of information and resources**.[64]

- **It is also the above mentioned central project clusters with which, in addition to information, also material and/or personnel is being swapped.** After all, 37 cases of exchange spanning several projects can be identified. This comes as a striking fact and implies that every other project spanning exchange taking place involves the “transfer” of personnel. It demonstrates, on one hand, a high degree of flexibility, trust and collaboration between the involved players. Taken together, these features are characteristic for networked relationships. On the other hand and with the intended support for young researchers in view, one could also talk, in this context, about a “GEN-AU-specific internal mobility and training scheme”.

- **Exchange of resources also takes place between the single projects of the respective project clusters as well as between the project clusters themselves:** The former type of swap prevails with the cooperative projects VP3 and VP1 and with pilot project PP4. “Cluster-spanning” exchange of resources is especially present with cooperative project VP2, with both of the network projects, but also with all the other pilot projects.

- **Functionally speaking, ELSA projects and especially associated projects seem to be largely isolated from the other project types.** In the case of ELSA this comes not as a surprise as from the perspective of natural scientists the contributions from the social sciences are obviously not regarded as be “functionally” essential for the success of their research undertakings.

Looking at the overall picture, one gets the impression of a complex functional web that involves a high degree of project- and cluster-spanning collaboration accreting especially around the cooperative and network projects.

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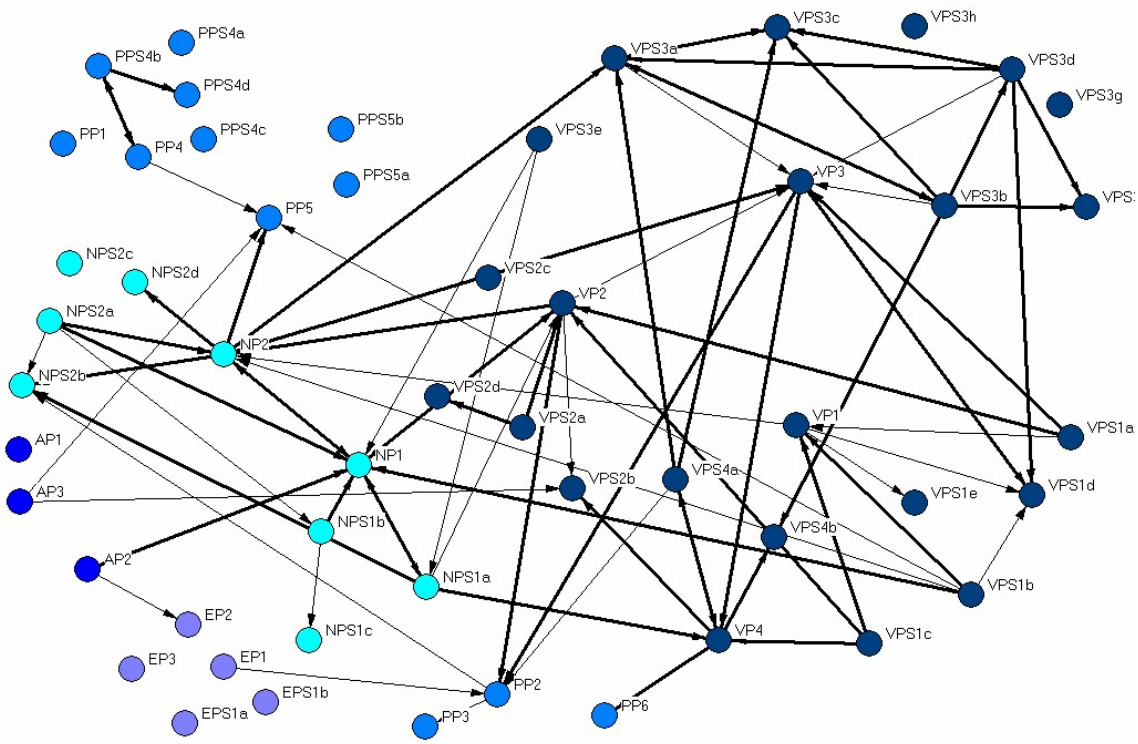
[64] The project leaders identified especially cooperative project VP3 (18 indegrees), the network projects NP1 and NP2 (12 and 11 indegrees, respectively) and the cooperative projects VP2 (9 indegrees), VP1 (8 indegrees) as well as VP4 (7 indegrees) as swap partners. Pilot projects (indegrees between 1 and 4) were much less frequently mentioned as exchange partners.

Graph 9 Functional Net – research-related exchange of resources



Remarks:

(1) The lines between the markers/players represent functional relationships between the connected players: A fine line stands for the exchange of research-related information only, while thicker lines show relations, where research-related information and material as well as personnel are being swapped. The arrow heads indicate the flow of information, that is, who is the "consignor" of the information and who is the "recipient".

(2) For the explanation of the abbreviations see the description in Appendix 12.3.

Source: Austrian Institute for SME Research

Aggregate Net

Based on the scrutinized *sub*nets – communication net and functional net – one can eventually establish an aggregate net that comprises all relations between the players involved with GEN-AU. Looking at this aggregate net (the net resulting from superpositioning both subnets) it becomes clear that one deals with a remarkably dense net, characterised mainly by multiplex relations: Of the 89 identified relations between project leaders that point to intense communication, 64 relations (corresponding to about 72 %) also involve research-relevant exchange of information, material and/or personnel.

To the extent that network theory has, for some time, acted on the assumption that multiplex relations indicate also intense and trustful relationships[65], one can argue, based on the high degree of multiplexity, that the GEN-AU net is relatively stable and characterised to a high degree by trustful relations. Thus, the GEN-AU net exhibits all features that are inherent to functioning innovation networks.[66] So far the results of the SNA lead to the impression, that the networking in GEN-AU has positive effects on the realization of the goals of the projects.

[65] See, for example, *Jackson et al*. (1977)

[66] Another argument for this assertion would be that the network structure existed, at least partially, prior to the set-up of GEN-AU, as indicated in many of the conducted expert interviews. Thus, there was no need to create a GEN-AU net from scratch. This is especially true for relations/relationships between subprojects of particular cooperative projects, network and pilot projects.

4.1.3 On the Importance of Relations, Relationships and Contacts

The image of a dense network of communicational and functional relations can be further substantiated by taking the importance of these relations for the success of the research undertakings, as seen and valued by the project leaders, into account. Similarly, the views of the actors active at the management level (they were asked to evaluate the significance of their GEN-AU relations for the success completion of their tasks) also back up the findings. The responses of the actors involved with GEN-AU lead to the following conclusions (see Graph 10):

- **The relations/contacts between thematically close subprojects are considered to be extremely important for the success of one's own work.**[67]

- **At the same time it becomes clear that important contacts are not restricted to "project clusters":** Actors who do not belong to the respective "project cluster" named the project cluster surrounding VP2 most frequently as an important contact (7 "cluster external" indegrees).[68]

- **Furthermore, it is remarkable that the coordinators of the cooperative projects VP1, VP2 and VP3, the network project NP1 and the pilot project PP5 exhibit to a high extent indegree-based centrality.** The high number of relations these participants are included in indicates that these actors actively pursue their function as coordinators.

[67] This is especially true for the contacts between the subprojects and the coordinator of cooperative project VP3 (19 indegrees); following VP3 are network project NP1 (8 indegrees), cooperative projects VP1 and VP4 as well as pilot project PP5 (all with 5 indegrees, respectively), and, finally, cooperative project VP2 and pilot project PP5 (with 4 indegrees, respectively). Within the respective cluster one can also find the, by far, highest amount of reciprocal relations. In such reciprocal relations two researchers consider each other as important or most important for their own research work.

[68] This is followed by the cluster surrounding PP5 (4 "cluster external" indegrees) as well as the cooperative projects VP4 and VP3 (3 "cluster external" indegrees, respectively). In this context one can notice the high importance given to the coordinators of the pilot project PP5 and the cooperative project VP2 by players outside of the respective clusters.

- **Contacts to two out of the three associated projects (AP1, AP3), three out of five pilot projects (PP1, PP2) as well as to three ELSA projects, for which we had responses, were not deemed really important by the other GEN-AU participants for their own research work.** This can be, especially in the ELSA cases, contributed to some extent to the low response rates in these two project categories. However, one has to consider that this might be only one reason for the relatively low significance attributed by the respondents. It could be that researchers working in the natural sciences do not see a lot of benefit for their work emanating from the social sciences, thus regarding the social sciences in this respect as an expendable "appendix".[69]

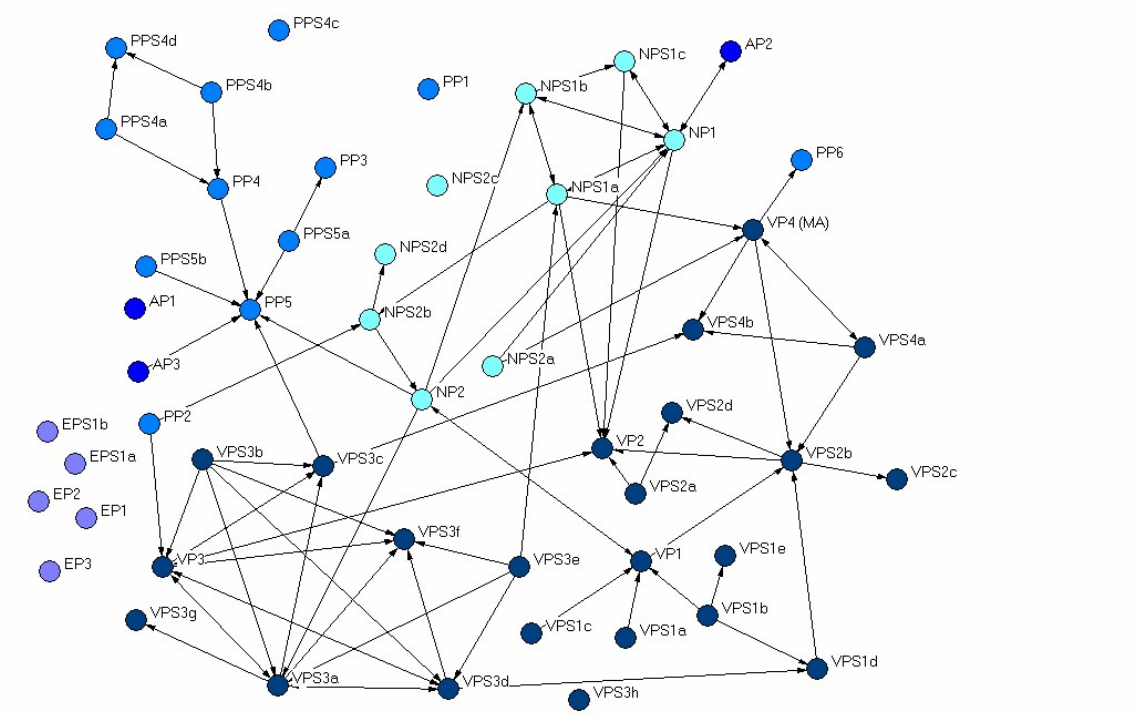
- **Hardly surprising, one can notice that the actors at the management level (programme office, programme partners) consider their mutual relations as important** (and communicate predominantly with each other). Other than that it is remarkable that five heads of projects say that their contacts to the programme office are important for their work.

The finding of generally project-type dependent networking is further sustained, if the responses of the project leaders concerning their perceived relevance of the relational links to other GEN-AU player/player groups for the success of their respective GEN-AU projects are taken into consideration (see also Table 12 and Table 13):

- According to the leaders of the cooperative projects and respective subprojects the relational links to other cooperative (sub-) projects are the primary determinant for achieving the set goals of their own projects. This self-constituted view can be also observed with the pilot- and network projects, in a, however, weaker form: Relations to other pilot (respective: network) projects are seen as important, but so are contacts with outside projects and/or project clusters, too. Network project leaders believe cooperative projects to be important to very important for their work. The project leaders of the cooperative projects, in turn, do not share this opinion (or better: the reverse view) to the same extent.

[69] One has to take into account the fact, however, that in our interviews not all researchers were signed up to the negative view on ELSA research: Sporadically, the mere existence of ELSA projects was highly welcomed ("very good", "these aspects are in any case important"); more frequently, the researchers would have liked ELSA to play the role of a promoter for genome research to the general public ("positive point: communication to the public"). In general, nonetheless, and statements given for example by the project leaders of the cooperative projects point in this direction, the "appendix" view seems to prevail, and there is supposedly no meaningful (e. g. relevant to the research goals of the cooperative projects) exchange taking place ("we are not in contact with the ELSA people", "we do not have direct interactions", etc.). Hence, the benefits of ELSA as well as the necessity to provide funding for this kind of research were questioned ("if we have to do it, we will do it", "if it is not expensive: okay"). Given these views it is not surprising that ELSA researchers have a very ambiguous perception of how their work is valued in the overall GEN-AU community, with opinions ranging from "we think that we are taken very seriously" to "ELSA was initiated only because all other countries utilize corresponding measures".

Graph 10 Networking in GEN-AU: Important contacts/links to GEN-AU partners



Remarks:

(1) Named player is the most import contract OR one of the important contracts in GEN-AU.

(2) For the explanation of the abbreviations see the description in Appendix 12.3.

Source: Austrian Institute for SME Research

- By all means remarkable is the fact that the relations to the project category "associated projects" are considered to be less important not only by the leaders of the other projects. Even the heads of the associated projects doubt the relevance of their undertakings, thus adding to the impression of the isolated position of this project type. On the other hand the heads of associated projects assume that their success depends substantially on the relations to the network and cooperative projects.

- The data also confirms the already mentioned rather weak integration of ELSA projects: Responses from the two leaders of ELSA projects who participated in the survey suggest that links and relations to other GEN-AU project are, in general, not vital to their research. In turn, leaders of other project types predominantly classify their links to ELSA projects as "rather unimportant" or even "unimportant" for their research work.

- Beyond their straight research-related contacts the project leaders consider their relations to the *management units* programme office, ministry and SAB relatively important for achieving the project goals. The programme leaders of the pilot projects seem to constitute the only exception to this rule.[70]

[70] This assessment is not pejorative as can be seen from the fact that the work of the management units is mostly positively valued by the leaders of the pilot projects.

Table 13 Rating of the relational links to GEN-AU player groups for the success of the projects – view of project leaders

„players/ player groups evaluated“ „judges“	*n*	Cooperative Projects	Pilot Projects	Network Projects	ELSA Projects	Associated Projects	Programme Office	Scientific Advisory Board	Programme Partner-Insitutions	bm:bwk
Cooperative Projects	*16 to 20*	1.4	2.9	2.3	3.5	3.2	1.7	2.0	2.5	1.6
Pilot Projects	*6 to 8*	2.5	1.5	2.0	3.4	2.8	2.4	2.8	3.2	4.0
Network Projects	*6 to 9*	1.5	1.7	1.0	3.0	2.8	1.7	1.7	1.8	1.3
ELSA Projects	*2 to 7*	3.0	3.0	3.0	2.3		2.0			
Associated Projects	*1 to 3*	1.5	2.5	1.0	4.0	3.0	1.5	1.0	3.0	1.0

Remarks:

Average values on a scale from 1 = very important, 2 = important, 3 = rather unimportant to 4 = unimportant;
grey shaded area: AVG ≥ 2.0

Source: Austrian Institute for SME Research

GEN-AU players/participants at the management level value their relations to the particular player groups with respect to successful completion of their tasks within GEN-AU as follows (see Table 13):

- Not surprisingly and given that it acts as an “interface” between research and (strategic) management, the programme office considers the contacts to all players “important” or “very important”. The interface function is also revealed by the fact that both players at the management level as well as project leaders predominantly regard their links to the programme office, as mentioned above, as important.

- Good relations to cooperative, pilot and network projects are essential to the programme partners. This is no surprise as these project categories are the focus of the partner network and constitute the core “customers”. The fact that the project leaders do not assign, in return, the same level of significance to the partner network is probably due to the service nature of the partner’s activities. The programme partners also value their contacts to the programme office, the ministry and the contacts among themselves highly. This kind of appreciation is returned by the mentioned management units.

- Good relations to the management units are inevitably important from the point of view of the ministry. In return, all players – with the exception of the pilot projects – attribute high significance to the ministry.

The question, whether only contacts within GEN-AU are important for the success of the projects or whether outside research groups in the life sciences play an integral role, too, can be also answered with the available SNA data. This is insofar of interest as successful innovation projects are usually characterized by the fact that their key researchers are able to pick up and integrate external ideas quite easily. Conversely, stuck relationships in “closed” networks can lead to unrealised innovation potentials as well as to missed learning processes. Against the background of this lock-in problem it is of interest that the GEN-AU nets do not seem to be separate and isolated from other outside research groups. Rather, there is sufficient evidence to support the hypothesis that collaboration between the project leaders in GEN-AU and outside domestic research groups as well as groups from abroad is indeed important for the research being conducted (see Table 14):

- Outside (that is, not in GEN-AU participating) Austrian researchers and research groups in the area of life sciences, are considered to be important or even very important by all project leaders, regardless of the project type;

- Contacts to research groups from abroad are a vital issue for successful research for cooperative, network and associated projects;

- Links to industry partners are particularly essential for the leaders of the network projects and, to a lesser extent, for the cooperative and pilot projects.

- Overall, the responses of the project leaders lead to the conclusion that GEN-AU is an open net with relevant (in the sense of relevant to the research goals) and active links to research and industry partners both from Austria and from abroad

Table 14 Rating of the relational links to genome researchers outside of GEN-AU – view of the project leaders

„players/player groups evaluated“ „judges“	*n*	Austrian Genome Researchers	Foreign Genome Researchers	Industry Partners
Cooperative Projects	*18 to 19*	1.5	1.8	2.1
Pilot Projects	*8*	1.5	2.7	2.3
Network Projects	*7*	1.8	1.8	1.8
ELSA Projects	*3 to 5*	1.0		
Associated Projects	*2 to 3*	2.0	1.0	3.0

Remarks:

Average values on a scale from 1 = very important, 2 = important, 3 = rather unimportant to 4 = unimportant; grey shaded area: AVG ≥ 2.0

Source: Austrian Institute for SME Research

4.1.4 Conclusion

Networking takes place to a high extent. The scrutinized communication and exchange networks are very dense and exhibit high levels of activity. Lock-in effects seem to be avoided. The extent, to which the GEN-AU programme has contributed to the networking, is, however, still a rather open question as many network relations have existed already prior to the implementation of the support programme. A future analysis could focus on the “added value” of GEN-AU with respect to networking by comparing the networking activities then with those scrutinized in this report.

The SNA leads to the following detailed conclusions:

- Both the quantitative and qualitative survey show high networking activities of the players involved in GEN-AU. The detected multiplex structure of relationships is based on a complex system of communication as well as an intensive exchange of research related information, material and personnel between the GEN-AU projects. The exchange of personnel takes place to a remarkably large extent.

- The cooperative and the network projects in particular are found at the centre of the network. They maintain notable close linkages both within their project-clusters, but also with players outside their respective clusters. Further intensive networking can be observed in three out of six pilot projects.

- The relationships between the already mentioned core players are characterised by intensive communication and, at the same time, intensive exchange of research related information linkages; they are thus to a large extent multiplex. This high degree of multiplexity indicates stable and trusted relationships between the involved players. In this respect the GEN-AU network exhibits characteristics which are of particular importance for the functioning of innovation networks.

- The associated projects and the ELSA projects are relatively isolated. This is in part due to the fact that project leaders of these project types were mostly reluctant to participate in the survey. In the case of ELSA projects difficulties, which are not rare in the interdisciplinary collaboration of natural scientists and social scientists, can also play a role for the marginal embedding within the GEN-AU network.

- The responses have shown that a lot of value is put to contacts within GEN-AU and to outside players/research groups (both in industry and in the academics). As far as this estimation reflects real acting it can be assumed that the GEN-AU net is an open net. Ideas and knowledge of relevant innovations in the field of international genome research can diffuse beyond the boarders of the GEN-AU network. Hence, GEN-AU seems to lack lock in situations that are problematic for many research processes.

- The results of the Social Network Analysis underline the fact that GEN-AU is a top-down programme. Of all management units it is the programme office that is particularly involved in the communication relationships. This reflects a) the interface function between management level and project level as well as b) a coordination function within programme management. Furthermore, the central managing entity, the Federal Ministry, keeps relatively intensive communication relationships, primarily with other management units. At the same time it should be noticed that the meaning of direct contact between some project leaders and the ministry should not be underestimated. Programme partner institutions interact primarily with other institutions at the management level.

- A further aspect: In many cases networks are conceived as a form of coordination that can be conceptualised and shaped easily by strategic players. This may apply to GEN-AU to a considerable extent. However, one should not lose sight of the fact that networks also can be conceived as developing entities which evolve over a longer period of time and which are not the result of strategically planned acting. Regarding the existing case it is our impression (which cannot be, however, quantified) that important linkages already existed before the programme was launched. This aspect matters insofar as the limits of strategic regulation and management of innovation networks become visible.

As a concluding remark, it has to be said that in view of the short monitoring time an empirically sound analysis for GEN-AU is not yet possible in order to detect a causal correlation between networking activities and research "success" – a fact that is, nonetheless, well documented in literature[71]. Such an analysis which could enable to make statements about the effectiveness of support measures in the research context has to be postponed to a later evaluation.

[71] *Scheidt* (1995); *Cooke* (1996); *Powell et al.* (1999); *DeBresson* (1991); *Ahuga* 2000

5 Proposal Review and Project Selection Processes

Our interviews showed that one crucial point in GEN-AU is the review and selection of project proposals. There were lots of rumours and innuendos about how the review is done, about reasons why a project was chosen (and why not), about the Scientific Advisory Board, about the thematic direction of the programme, and so on. Before getting to the bottom of all these matters (that are, in fact, threatening the overall success of the programme), we will discuss in some detail the Scientific Advisory Board, evaluation procedures of the different project types, and the evaluation conferences.

5.1 Scientific Advisory Board

According to the preliminary standing orders of the SAB at hand, this board is responsible for the supervision, control and overall progression of GEN-AU. The Scientific Advisory Board is responsible for the project appraisal and selection processes[72]. In order to assure international competitiveness of GEN-AU the board has to take the necessary decisions regarding the structure, the activities of the appropriate bodies and the scientific strategies and contents of GEN-AU. Thus, the board can be seen as responsible for the thematic approach within GEN-AU. From the evaluators' point of view, the SAB, therefore, can be regarded not only as a jury, but as a steering committee. While a jury is only responsible for selecting projects along certain criteria, a steering committee gives clear direction on a strategic as well as on a thematic level. In a short article, a former member of this board, Gottfried Schatz, describes the dynamics in this committee as follows:

> *"In the end, we struck out the weak parts of the applications and tried to strengthen the good parts by recommending additional studies, or recruiting of other scientists. Instead of judging the applications, we were rewriting them*."[73]

This dual role of a jury and steering committee is rather unusual, at least in Austria's science and technology policy. It reflects the top-down character of GEN-AU: not only is a topic is given, but also the proposed projects are revised and redirected in a certain direction decided by the appraising board of scientists.

This is, as mentioned above, unusual – no comparable Austrian science and technology programme has such a powerful board – it is quite risky (policy failure), but it is, nevertheless, legitimate if certain principles are adhered to: a maximum of transparency and much care when appointing the members of the board.

In period I of GEN-AU, there were fluctuations regarding the composition of the board. The SAB is appointed for three years by the Minister of Education, Science and Culture. Board members may serve a second period on the Scientific Advisory Board and may suggest their successors. In phase I of GEN-AU, FWF, FFF (now part of FFG), ÖAW and the Austrian Rectors' Conference proposed the members of the Scientific Advisory Board. This approach has been abandoned after the first period of action of the committee. The composition of the SAB for phase II of GEN-AU has only been announced recently. The announcement has been made after the closing of the first two calls for phase II of GEN-AU.

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[72] The Scientific Advisory Board is not in charge for ELSA projects.

[73] *Schatz* (2003); in his article, Schatz criticizes not so much this procedure, but mandatory network schemes.

Because of the powerful position of the SAB, the fields of scientific expertise of the board members have been compared with the research topics of the projects funded so far. The topics more or less match. The new board in phase II of GEN-AU also shows a shift in the nationalities of the SAB members. By now, only two Austria based scientist serve on the board; most of the others are located in Germany.

Regarding the professional origin of SAB members it needs to be pointed out that in phase I GEN-AU scientists with a predominantly academic background served on the advisory board. This is also true for the new board.

Comments by the evaluation team

As the topics of projects in phase II of GEN-AU cannot be predicted gaps in the expertise of the Scientific Advisory Board may also occur in the future. In order to assure optimal guidance and support for the projects it may be necessary to extend the advisory board according to the actual project portfolio. In addition, the representation of business circles may require reconsideration.

5.2 Goals Confronted with Proposal Selection Criteria

The identified goals of GEN-AU have been compared with the funding criteria that are stated in the different call documents. Table 15 summarizes the obtained results.

Most of the selection criteria concern the goal to promote science. Some of the criteria in this context vary with the project type, but there are two evaluation criteria that are common to all types of projects:

- Innovative scientific potential in relation to the international level of research
- The scientific expertise of the proposer and the project leaders and their capability to generate scientific input through the submitted project

For all other goals only a very limited number of selection criteria have been formulated. These basically vary with the project type or are only developed and implemented during the course of the programme. For example, all calls that have been launched after the first call for cooperative projects request a gender mainstreaming strategy in order to promote women in leading positions.

The goal to increase public acceptance of life sciences may loosely be associated with the request to integrate users in ELSA projects. Regarding criteria for ELSA projects minor differences between the criteria stated in the call documents and those on the checklist for reviewers have been detected. These differences are linked to a different wording. As regards content, the criteria are more or less identical (see also Table 17).

For two goals, no corresponding evaluation criteria have been identified:

- Labour market: Create new jobs
- Promote technology transfer and industry: Strengthen existing companies / Promote the location

These goals are, however, implicitly connected to the funded research projects. With the majority of the grant money researchers are employed; therefore, GEN-AU does create new jobs. However, this seems weak from a macroeconomic point of view where job creation is interpreted to mean jobs beyond the project research jobs.

Regarding the promotion of technology transfer and industry the call documents of phase I of GEN-AU state that working groups participating in GEN-AU projects may not only be based in academia, but also industry. Only the funding differs: Academic research groups receive 100 % of additional costs, industry up to 50 % of full costs. According to the call text these funding percentages correspond to the scale for national R&D allowances of the European Commission. By allowing existing companies located in Austria to go for GEN-AU funding, the second goal listed above is also embraced by GEN-AU projects. However, especially for encouraging technology transfer, for further strengthening existing companies, for promoting the foundation of start-ups and for promoting the location, instruments might be necessary that go beyond this level of support. IPR workshops that have already been offered to GEN-AU participants constitute such a line of activity.

Table 15 Goals of GEN-AU compared to selection criteria

Goals of GEN-AU		Selection criteria	Cooperative projects (phase I)	Cooperative projects (phase II)	Networks (phase II)	ELSA projects (phase I)
Promote science:	Boost strengths and fill gaps	Innovative scientific potential in relation to the international level of research	x	x	x	x
		The scientific expertise of the proposer and the project leaders and their capability to generate scientific input through the submitted project	x	x	x	x
		Integration of relevant "high-end methods"	x			
		Feasibility of the developed technologies of methods, applicability for biological questions			x	
	Create critical masses	Contribution to the establishment of broad utilizable scientific infrastructure; capability to create a "Centre of Competence" (in terms of the "European Research Area")	x	x	x	
	Promote internationalization	Cross-linking with further national and international research activities as a basis for synergy effects between research teams and areas	x	x		x
		Integration and repatriation of an international research team	x	x		
Create knowledge to enhance health and protect environment		Contribution to the achievement of the objectives of GEN-AU; agreement with prevailing ethic directives	x	x	x	
Labour market: Create new jobs						
Promote women in leading positions		Gender Mainstreaming		x	x	x
Education: Build up human resources, promote young scientists		Contribution to the promotion of young scientists	x		x	x
Promote technology transfer and industry:	Create patents and start-ups	Prospects for generating patentable results	x	x	x	
		Chances for efficient and targeted technology transfer and potential for spin offs	x	x	x	
	Strengthen existing companies					
	Promote the location					
Increase public acceptance of Life Sciences		Integration of "users"				x

Remark: Networks of phase I of GEN-AU are not included in this table because this project type was not explicitly put out to tender.
Source: GEN-AU (bm:bwk 2001A, bm:bwk 2003, bm:bwk 2004A, bm:bwk 2004B); compiled by Joanneum Research

First of all it should be noted that a rather large number of evaluation criteria is used in the context of GEN-AU for project selection (see Table 16) and that no indications are given on the relative importance of the different criteria. This makes it difficult to comprehend the details of the selection process. In addition, no protocols of the meetings of the Scientific Advisory Board and no project reviews have been made available to the evaluation team.

This section therefore focuses on those parts of the project selection procedures that can be analyzed with the available documents.

Graph 11 shows the stages of project selection in the context of GEN-AU. The drawing also gives an impression of the time these stages take. One of the most important (because it is the most limiting) timeframes is how long the call is actually open. This time frame starts with the publishing of the call documents. Applicants have until the end of this period to design and submit a short proposal that states the cornerstones of the proposed project. In phase I and in case of the first calls of phase II of GEN-AU, the corresponding period is limited to one or two months. Bearing in mind that in the literature it is reported that large research projects may need a year or even more time for their preparation,[74] this period has to be regarded as very short.

A comparison of the time frames that are in place for programmes that may be compared with GEN-AU because of their structure has been carried out:

- In case of the Austrian NANO initiative[75], there is also only two months time for preparing cooperative projects. For submitting proposals for networks the time frame is much longer as there are three dates to hand in project proposals, one of them about eight months after the publication of the call.
- So-called “Sonderforschungsbereiche” (SFBs or special research areas) have no deadlines, therefore no comparable time frames are available. On the web there are, however, statements from Austrian universities stating that certain SFBs took two or even three years time for preparation[76].
- Three calls in FIT-IT gave researchers four months time to prepare their tenders, two calls have been open for about three months and one call has been open for 1 month.

Apart from that, Graph 11 also makes clear that the theoretically stated time span which is stated to be required to get projects started after their official approval can vary a lot. ELSA projects theoretically started four times faster than all other project types.

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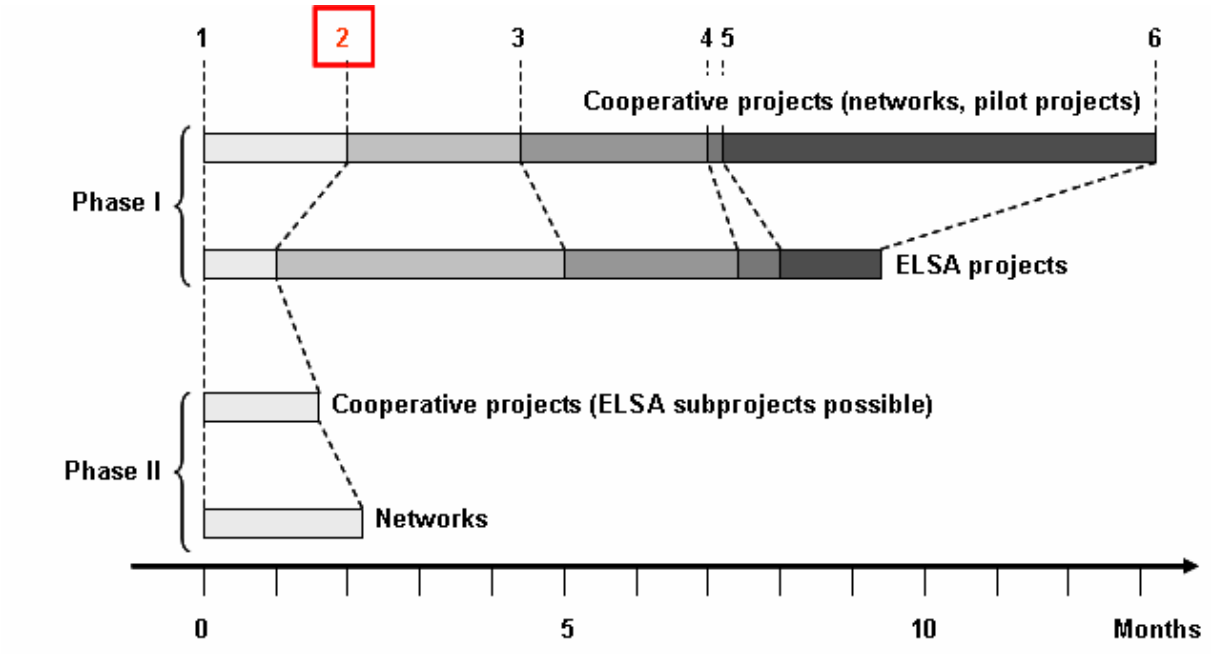
74 See *Laudel/Grit* (1999)

75 http://www.asaspace.at/, Jan 11, 2005

76 http://tourism.wu-wien.ac.at/cgi-bin/ift.pl?/services/coollinks/etourism.htm, Jan 11, 2005; http://www.uni-graz.at/communication/unizeit/archiv/vor1999/195/1-95-08.html, Jan 11, 2005

Graph 11 Stages of project selection (theoretical time frames)



Stages of project selection:
1 Call for proposals
2 Time limit for short proposals
3 Time limit for full proposals;
4 Funding recommendation by the scientific advisory board / jury
5 Approval of projects by the Federal Minister of Education, Science and Culture
6 Start of projects

Source: GEN-AU, compiled by Joanneum Research

Table 16 reflects the 2-step selection procedure that is applied in the context of GEN-AU. During this process a number of short proposals were selected by the SAB and the corresponding applicants were invited to submit a full proposal. These were subjected to international peer-review and the reviews served as basis for the funding recommendation formulated in a SAB meeting.

In Table 16 the numbers of short and full proposals per project type are contrasted with the numbers of funded projects. As mentioned earlier in phase I of GEN-AU networks and pilot projects were only created after the end of the call for cooperative projects. During this process, parts of some cooperative projects were split or merged in order to create pilot projects. Networks were also set up. For these reasons the total number of funded cooperative projects, pilot projects and networks is larger than the number of submitted full proposals for cooperative projects. Regarding the GEN-AU associated projects, no numbers are available concerning short and full proposals.

Table 16 Projects in brief: numbers of short and full proposals per project type

Project type	Number of short proposals	Number of full proposals	Number of projects
Cooperative projects	31	9	4
Networks			2
Pilot projects			6
Associated projects	n.s.	n.s.	5
ELSA projects	21	9	6
Sum	52	18	23

Source: GEN-AU; adapted by Joanneum Research

5.3 Proposal Review and Project Selection in Phase I

In response to the call for cooperative projects in phase I of GEN-AU 31 short proposals were submitted. These were subjected to a two-step evaluation procedure. A hearing of project representatives took place and the Scientific Advisory Board invited 9 of the 31 applicants to submit full proposals. On the basis of the short proposals the Advisory Board selected international peers for the reviewing process. The GEN-AU office contacted these peers while full proposals were being prepared. After submission of the full proposals they were transferred to the reviewers. At minimum, five reviews per project were obtained. In addition, the Austria Wirtschaftsservice GmbH (aws) assessed the project's innovation potential regarding patents. The external reviews were used by the Scientific Advisory Board for preparing the funding decision for the Federal Minister of Education, Science and Culture. In case of conflicts of interest SAB members had to leave the SAB meeting. The SAB provided the ministry with a ranking of the submitted project proposals.

The views of our interviewees on the project selection vary. ELSA project leaders have a very positive view of the two-step selection processes. They stated that the processes were fair, transparent and that they even received reviews and comments from the peers involved in the reviewing processes.

Project leaders, subproject leaders and managers of the other projects have a different perception of the review and selection procedures. The majority of them expressed concern regarding the process. The following illustrative comments suggest the nature of the concerns

> *"The real heart of the problem is: the expectations! If you invite a squad of international researchers, they are not happy to see applied projects. You have to think of who is in the expert panels!"*

> *"At one point, money came in and nobody knew its origin and why"*

> *"We got the project because the ministry wanted to give money to [our institution]".*

Those who did not get project funding criticized the same points as mentioned above and could hardly see anything positive in the project selection procedures. Some of them also pointed out that no good reasons were provided for the denial of their projects.

Despite these concerns, however, it should be noted that all beneficiaries are very positive about the two-step review process itself, and, in general, regarded the procedures in place for the selection of projects to be appropriate. It was the application of the procedures that appeared to give rise to the concerns rather than the procedures per se.

In phase I of GEN-AU all applicants had to give oral presentations of their short proposals which was not considered a good idea by some of our interview partners. For phase II this has already been changed and only those who are invited to submit a full proposal need to present orally in front of the SAB. Some of our interview partners suggested allowing extra time for discussion.

5.3.1 Review and Selection of Cooperative Projects, Networks and Pilot Projects

During the appraisal process of cooperative projects two new project types came into play: 'pilot projects' and 'networks'. On the basis of the recommendation by the SAB, the minister approved four cooperative projects, two networks and six pilot projects. These officially started in November 2002 after extensive contract negotiations. To put the project in place required not only signing the Ministry's funding contract, but also a consortium agreement between the project partners, and, in addition, an aws contract for support with IPR issues.

Table 17 summarizes the dates of the central steps in the evaluation of cooperative projects.

Table 17 Steps of the evaluation of cooperative projects that also lead to networks and pilot projects

Time point	Step
07.09.2001	First call for proposals
05.11.2001	Time limit for short proposals
15.02.2002	Time limit for full proposals
27.04.2002	Funding recommendation by the scientific advisory board
30.04.2002	Approval by the Federal Minister of Education, Science and Culture
01.11.2002	Start of projects

Source: GEN-AU; compiled by Joanneum Research

5.3.2 Review and Selection of Associated Projects

Associated projects were selected without competition. Nevertheless, according to the GEN-AU office associated projects have also been subjected to international peer review. However, no documentation is available to the evaluation team reflecting the appropriate steps of the evaluation. The evaluation team assumes that the interim evaluation of these projects will be in the same form as other projects.

5.3.3 Review, Selection and Interim Evaluation of ELSA Projects

Table 18 lists the steps leading to the start of ELSA projects and the associated time points. Review and selection of project proposals have in principle been carried out the same way as in case of other projects: Short proposals were screened and some applicants were invited to submit full proposals. In case of ELSA, 9 out of 21 short proposals passed this stage. Full proposals were internationally reviewed by peers.

The only big difference when comparing this process with the evaluation of other project types in GEN-AU is that the Scientific Advisory Board has not been heavily involved in the project selection. As stated above, it is not responsible for ELSA projects.

To substitute for the SAB, an internal jury has been constituted that among other members included ethicists from the Federal Ministry of Education, Science and Culture, and members of the GEN-AU office. This jury proposed reviewers and by making use of the "snowball effect" (reviewers suggest other reviewers), enough reviewers were found to allow two to four reviews to be obtained for each project. In addition, reviews from the ethicists in the SAB were obtained. The reviews served as basis for the funding recommendation. After the approval of six projects by the Federal Minister of Education, Science and Culture on December 15th 2003, the ELSA projects started in February 2004.

ELSA projects are also subjected to interim evaluations. The projects have to deliver an interim report which is forwarded to international reviewers that provide the GEN-AU office with a written report. The internal jury will also check the interim reports. No special evaluation conference is planned for ELSA projects. However interested ELSA scientists have the possibility to participate in the yearly evaluation conference of the other projects. The first annual evaluation of ELSA projects is not yet finished.

Table 18 Steps of the evaluation of ELSA projects

Time point	Step
15.04.2003	Call for proposals
16.05.2003	Time limit for short proposals
12.09.2003	Time limit for full proposals
01.12.2003	Funding recommendation by the internal jury
15.12.2003	Approval of projects by the Federal Minister of Education, Science and Culture
01.02.2004	Start of projects

Source: GEN-AU; compiled by Joanneum Research

5.4 Evaluation Conferences

In GEN-AU regular interim evaluations of projects are carried out. In addition to interim reports evaluation conferences have been established where project participants and SAB members meet to discuss all projects. Interim reports are circulated among the members of the Scientific Advisory Board before the conferences. The SAB has the power to define the direction in which projects should go in the future and it can also close down projects based on interim evaluation results.

In October 2003 the first interim evaluation of the projects took place. At the joint evaluation conference the project teams gave short oral presentations and also presented posters. Presentations, posters and interim reports served as a basis for the evaluation.

After the first interim evaluation all projects were continued. This also holds true for the second interim evaluation that took place in November 2004.

In contrast to the first evaluation conference, some interviewees criticized the second evaluation conference for not having provided enough time for presentations, discussions, etc.. In addition, the location was criticized (the room only allowed a limited number of participants to see the speakers) and the project leaders would have liked to receive more feedback from the SAB.

Comments by the evaluation team

For the interim conferences a shift in its meaning has been reported. According to our interview partners what was first experienced as an assessment day has become more like an Austrian Genome Science Day involving a lot of communication and networking.

Only a very small number of interviewees are convinced that annual evaluations within GEN-AU are necessary. In particular, the evaluation after the first year has been criticized as most results that were presented are considered to be results that have been created in the phase of appraisal. Mid-term evaluations or bi-annual evaluations are regarded as more suitable by most interviewees. Annual written reports are, however, generally regarded acceptable by project participants.

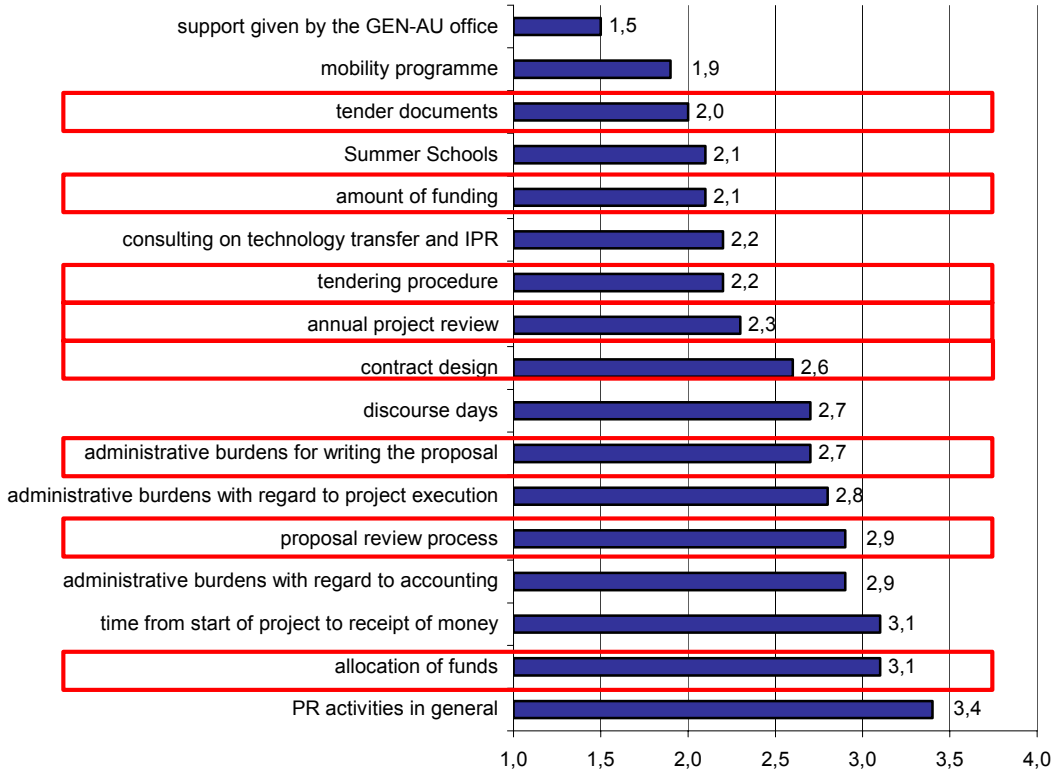
In order to preserve the perceived positive effects of evaluation conferences, namely to have opportunities to get in touch with researchers from other projects, most interviewees would, however, like to keep the annual conference as a "networking day".

5.5 Satisfaction with Different Aspects of the Evaluation, Selection and Review Procedures

Graph 12 also shows the satisfaction levels for different aspects of the project selection and evaluation procedures. Clearly, the project leaders participating in the survey were – on average – mostly satisfied with the amount of funding (rating given on average: 2.1), the tender documents (rating: 2.0) and the tender procedure (2.2).

On the other hand, and because of the double roles and rumours mentioned, proposal review procedures (average rating: 2.9) and allocation of funds (average rating: 3.1) were given rather unsatisfactory grades. Interim evaluations (annual project reviews, average rating: 2.3), contract design and administrative burdens for writing the proposal (rating: 2.6 and 2.7, respectively) showed only average satisfaction levels.

Graph 12 Satisfaction with different aspects of the GEN-AU programme, average values *)



*) scale: 1=very satisfied (A), 2=satisfied (B), 3= averagely satisfied (C), 4=rather unsatisfied (D), 5=not at all satisfied (F)

N=29-39, depending on aspect rated

Source: Austrian Institute for SME Research

5.6 Power and Influence in GEN-AU

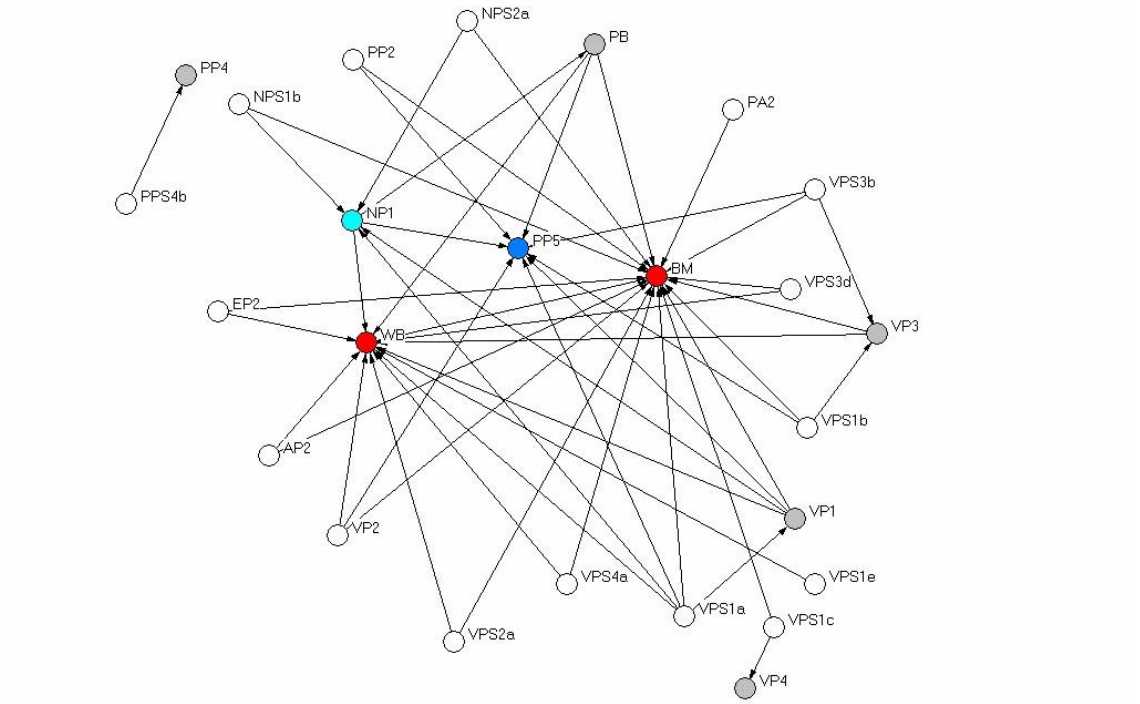
The relations between the actors in a network are not only characterized by the exchange of resources and ongoing communication processes, but also by the balance of power prevalent. Some actors/players have power over others because they have exclusive access to certain resources while others depend on those exerting control. This is especially important for the strategic aspects of programme management, for example for the thematic orientation of the programme and – closely related to this issue – for the allocation of funds.

Following respective approaches, which are developed in the context of policy research[77], the influence a player/actor has is set equal to the perceived influence of this player, as seen by all other actors. The "value/amount of influence" is henceforth defined to be the arithmetic mean of all the respective individual assertions by the other players (so-called indegree-based position of influence). Powerful actors are consequently those persons who find themselves in such a "power and influence"-web in a primary position of influence. In the course of the online survey all actors were asked to name persons and player groups within GEN-AU who supposedly have influence on the thematic orientation of the programme, on the allocation of funds and on the presentation of results in the scientific public (indegree-based centrality). Furthermore, the respondents had to quantify the amount of influence assigned using an ordinal scale.

[77] See *Burt* (1977); *Jansen* (1995); *Bonacich* (1987)

By combining the answers to the question of influence on thematic orientation into a network, a structure as depicted in Graph 13 becomes apparent. It can be described as a “double star system” with “two giant planets”. The ministry and the SAB form the two stars which means that respondents predominantly assert that these two players have a lot to say on thematic issues within GEN-AU. Interestingly, though, there is some agreement that two projects (pilot project PP5 and network project NP1) play also an important role and possess a considerable amount of power. This picture does not change a lot if the respective networks for the questions of influence on allocation of funds and influence on presentation of results are set up.

Graph 13 Power and Influence on thematic orientation of GEN-AU



Remark: For the explanation of the abbreviations see the description in Appendix 12.3.

Source: Austrian Institute for SME Research

The GEN-AU web is characterised, from the point of view of the players/actors, by a strong strategic position of the “upper” programme management units. The relatively high funding volumes might play a major role for this assessment. This is also underlined by the fact that the project participants highly appreciate the financial attractiveness of the programme (see also section 3.4.6 on deadweight effects, where it is shown that almost all respondents believe that the projects could not have been carried out to the same extent and/or scope without GEN-AU support).

The central position of the ministry is also a strong indicator of the top-down approach being taken. The significance of the ministry and the SAB is, consequently, not surprising. The importance assigned to a network project, given, among others, its service function, is also understandable. However, the fact that a pilot project plays a crucial role is rather intriguing.

5.7 Conclusions

As was mentioned in the beginning of this chapter, we learned about the importance of the proposal review and project selection processes, and we also learned of rumours and innuendos circling around the review and selection decisions of Phase I.

Here we try to capture for summary the origins of these rumours.

5.7.1 A New Spin in GEN-AU

GEN-AU was originally designed as a Public Private Partnership with a strong focus on industry and technology transfer aspects but not so much on research quality. For several reasons, this general direction of the programme changed even before it really got started. In the interviews these changes were often attributed to the composition of the SAB that was, with one or two exceptions, composed of basic researchers. This is considered to be the reason why in the end scientific quality has been the main criterion in the selection of projects. This it is not what had been announced and is, therefore, a point of critique. In brief, some scientists have the impression that the announced criteria were actually not those that were applied in the proposal review. One scientist even stated that he designed a project that was more linked to basic science because of the composition of the SAB, as opposed to being responsive to the announced criteria.

5.7.2 Double Roles

During the last years, the importance of peer review has increased worldwide and so has the time researchers spend as reviewers. It is a hard and competitive job to find good people to serve as peers in a reviewing process or as jury members. Moreover, regarding the composition of a Scientific Advisory Board there will always be a trade-off between 'lily white people' who are so far removed from the field that they lack the necessary competencies to assess projects, and deeply involved researchers who know the field well, but who may arouse conflict-of-interest concerns. This is especially true for small countries and thematically narrow fields of research. As in GEN-AU, this could lead to researchers with double roles (whereby some researchers are members of the Scientific Advisory Board and at the same time programme beneficiaries). These double roles have aroused much unease, both with winners and losers (see section 5.8.5).

5.7.3 New Project Types

The next point of critique refers to unclear procedures used to create networks and pilot projects after the programme started. Obviously, the Scientific Advisory Board decided to initiate a project type (networks) to provide other research groups with necessary infrastructure and services. The starting point of these projects were parts of existing proposals, but the SAB additionally invited groups outside the GEN-AU proposals to join these (upcoming) networks. Thus some applicants were not approved, while some non-applicants were approved.

The SAB also did some 'cherry picking': Out of the failed proposals, it selected certain parts that it wished to see funded and created so called pilot projects. The idea was to give some groups time to further develop ideas or techniques that will allow them to propose full-blown co-operative projects in the next phase of GEN-AU.

In this context incomprehensible decisions and unclear communication of selection results have been criticized, too.

5.7.4 Associated Projects

In 2003, the Austrian Council for Research and Technology Development earmarked some additional money to be spent in GEN-AU. “Associated projects” came into existence. The problem here is the way the money was spent. It resembles more the tradition of contract research in Austrian ministries than the usual competitive peer review procedures used in research programmes. Ideas are presented to the ministry and the decision makers in the ministry decide whether they promote this idea or not. The bm:bwk has a long tradition in this kind of contract research. Anyway, all ideas that made their way to associated projects were peer reviewed and met high quality standards.

5.7.5 Review and Selection Procedures

At this point, we want to sum up and give some recommendations concerning the procedures for reviewing proposals and selecting projects:

- **Ensure more transparency in the evaluation procedures.** We strongly recommend that the ministry not pass over this problem in silence, but rather put a lot of emphasis on ensuring more transparency within GEN-AU: exclude the possibility of double roles (e.g., a person being both programme beneficiary and member of the SAB); do not fund new ‘associated projects’; communicate clearly the proposal review and project selection processes to the scientific community; adhere to those processes rigorously.
- **For the future: follow the way chosen in the beginning with respect to reviewing and selecting projects.**
- **Take care that the SAB does not change the rules of the game after the game has started.**
- **Do not invent new project types when evaluating proposals.**
- **Define a “roadmap”:** There was a crude “roadmap” of GEN-AU defined and published when the calls were launched, but no precise one. As a result, deadlines (e.g. regarding the date for submission of full proposals, dates for evaluation conferences, discourse days etc.) have only been set in phase I of GEN-AU. This should be changed to allow for mid-term or even long-term planning.
- **Find a workable trade off regarding the composition of the SAB** that is positioned between the two prevailing extreme views, i.e., "Good people are always very involved" versus "Lily white people do not understand the system."
- **Consider using the annual conference for networking and information exchange rather than for the project evaluation,** and schedule the project evaluations of both ELSA and other projects on a mid-term or bi-annual basis, followed by a more in-depth impact assessment a few years after the end of the projects.
- **Try to increase communication between ELSA projects, but also between ELSA projects and other projects.** This could be achieved via a joint annual “networking” event (meeting) of all GEN-AU projects with sufficient time allowed for all projects to be presented. However, in addition, a special meeting for ELSA researchers may be needed to promote interactions. Smaller topic-specific meetings may in general be a good possibility to supplement the networking efforts.

6 Young Researchers, Female Executives and the Labour Market

6.1 Introduction

A majority of support programmes have – either explicitly or implicitly – at the very heart of all goals the aim to increase and/or secure employment levels in a particular industry or region. The corresponding goal in GEN-AU has been clearly stated and quantified: Within the running time of GEN-AU, it was initially sought to create 20 to 30 new start-ups with around 2,500 to 3,000 employees.[78] This would imply a fivefold increase over current employment figures.[79]

While it is clear that these estimates were made at the height of the biotech bubble, virtually all experts interviewed acknowledged the ambitiousness of the target even if adjustments for the bubble burst were made. Opinions were mixed, however, when it came down to the question of whether GEN-AU could realistically achieve these target figures. One part of the interviewees stated that this would be possible if enough "pressure" were exerted on the researchers by applying tough standards to proposal and project reviews. The other part contemplated that – due to the nature of the projects (more basic-research-oriented) – one could not expect enough patent applications within the given timeframe that are needed to form a solid basis for start-ups employing additional personnel (this opinion was prevailing among the scientists working in GEN-AU projects).

Almost all experts agree on two things regarding the Austrian labour market in the life sciences: On one hand, there has to be a long term perspective visible for researchers to remain in or move to Austria. On the other hand, an active venture and risk capital market is necessary.

In this chapter we will scrutinize the measures in place within GEN-AU that aim directly or indirectly at increasing employment. We will also analyse the opinions and needs of researchers (especially young researchers) on doing sustained research in Austria. Finally, we will take a look at the current state of the venture capital scene with regard to genetic engineering in Austria.

6.2 The Austrian Labour Market for Genome Researchers

According to the GEN-AU homepage, Austria has currently around 500 to 600 people working in the life sciences (biotechnology and genomics companies).[80] In order to increase this figure, an adequate environment for the researchers in terms of research possibilities must be established and sustained, including the availability of up-to-date laboratories, little administrative burdens, educational facilities and remuneration schemes.

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78 http://www.gen-au.at/, Dec 9, 2004

79 There still remains the issue of the way „employment" is defined in this context. For example, one could consider long-term positions created, but one could also take into account short-term positions (temps) or the amount of people who have occupied either long- or short-term positions over time.

80 http://www.gen-au.at/, Oct 18, 2004. This figure seems, however, somehow low as some experts stated that Campus Vienna Biocenter alone has around 1,000 persons on its payroll.

All interview partners, young researchers and labour market experts alike, underline that the high schools as well as the universities have a relatively high educational standard. A highly acclaimed programme (the Vienna Biocenter PhD programme) helps to further improve the situation for Austrian students in the life sciences (and to improve the situation in the life sciences themselves, too). Still, problems arise when it comes to offering university graduates adequate research and employment possibilities. A continuous career at the university is out of reach for most of the talented young researchers, and a tenure track system is not present.

These problems constitute a big challenge. All interview partners agree that it is imperative to keep graduates of the universities doing research in Austria and, similarly, to increase the countries´ attractiveness for excellent researchers from abroad.

Several programmes deal with the latter issue. “Brainpower Austria”, run by FFG (Österreichische Forschungsförderungsgesellschaft, Austrian Research Promotion Agency), aims at attracting high profile researchers (though mostly Austrian by origin). A similar programme, the “Schroedinger Return Programme”, has been recently cancelled. Officials from the cities of Vienna and Innsbruck as well as Federal representatives have been entering bilateral negotiations with large pharmaceutical companies and renowned researchers in order to have them establish research facilities in Austria. Rent allowances and discounts are, among others, the instruments of choice.

Regardless of all these efforts, the interviewees have, for the most part, a relatively negative view of the Austrian labour market for researchers within the life sciences and also for genome researchers. The main reason is the “lack of a long-term perspective”, as almost all interview partners put it. This lack of long term possibilities has a number of reasons, including limited availability of public funds for long-term research projects, scarce open positions at private research facilities and at biotech companies, age restrictions for mobility schemes and FWF (Austrian Science Fund) grants as well as limitations on the number of proposals a scientist can submit to the FWF in order to receive a grant.

As a result, the planning horizon for “ordinary” genome researchers in Austria rarely exceeds three years, after which most researchers have to look for new job opportunities, for a new research project. Hence, many move to another country. Others stay in Austria but do not work in research any more. This is especially true for many women, where the age restrictions hit exactly at the time studies are finished and family planning (conflicting with research career goals) becomes an issue.

Conclusions:

Despite of a number of specialised labour market initiatives and rather good educational standards (which allow for ample supply of qualified personnel) the Austrian labour market for genome researchers is currently rather small and long-term job and research opportunities are scarce. GEN-AU can contribute only little to enhance the situation but does so by addressing the long-term perspective issue for at least a limited number of research groups. The possibility to have projects funded for around a decade has been praised by several interview partners and will certainly help to secure a number of high quality jobs in research. In addition, its promotional activities and the Summer School might help to improve public support for genome research, strengthen the educational base and eventually secure future funding.

In order to reach the targeted employment figures, GEN-AU will have to rely heavily on private sector investments in start-ups. As GEN-AU is focussed on research it cannot and should not, however, offer broad support for private investors. This issue is tackled by other schemes, for example by the seed financing programme or the uni venture fund of the aws.

6.3 Young Researchers in GEN-AU

The term “young researchers” is applied to a rather heterogeneous group of people. This group comprises high school and college students as well as graduated and already experienced researchers in their thirties or even early forties. Measures aimed at high school and college students focus for the most part on educational measures but can also be regarded as public relations activities. One of the aims is to get as many talented people to study genetic engineering or a similar subject and to provide good education facilities. With researchers who have already some experience in genome research the focus shifts to providing actual and adequate research possibilities.

The general problem of the “older” young researchers has been already mentioned in the previous section: The lack of long-term perspectives due to limited job offers in Austria in public and private institutions, age restrictions in connection with scholarships and mobility schemes, etc.. The GEN-AU programme design is based on the idea of fostering the already strong and established research groups. Consequently, little money is available to create new research groups.

Within the Austrian Genome Research Programme GEN-AU, two measures to promote the next scientific generation can be identified: The **“Mobility Programme”** aims at young researchers which are involved in a GEN-AU-project and the **“Summer School”** addresses high-school students.

6.3.1 GEN-AU Summer School

The Summer School was created to give interested pupils insight into the day-to-day work of genome researchers. From a long-term perspective the Summer School also aims at increasing public acceptance of genomics. The Summer School is conceptualised and organised by dialog<>gentechnik and the GEN-AU office. The first Summer School took place in July and August 2003. Eighteen high-school students participated in the first Summer School. In 2004, more than 250 students applied and 59 were eventually given the chance to participate in the Summer School. A Summer School will be also offered in 2005.[81]

[81] In 2005, students will also have the possibility to work in labs that are not involved with GEN-AU funded research.

The main goals for the Summer School are to allow high-school students to get engaged with practical laboratory work, to give potential future researchers a decision support for the choice of the field of their studies, to increase their knowledge about genome research and to enhance contacts to the researchers. Researchers on the other hand are believed to profit from dealing with non-scientists, too (for example by improving their teaching skills).

In past Summer Schools, high-school pupils had to meet a set of criteria for participation: They had to be at least 16 years old, provide a letter of intent and a curriculum vitae and pass a face-to-face interview with a potential coach.[82] The high-school students were informed that they will deal with expensive equipment and that they will have to write a documentation of their work in the laboratory. It was announced that the best documentations would win a prize.

The project leaders interested in supervising high-school students in the context of the Summer School were provided with a suggestion on how to structure the schedule for the 3-4 week internship. They were asked to provide information on their institution, their laboratory and the project the high-school students would work on. Project leaders were also asked to stimulate the Summer School students to become active in contributing to the school press or other media.

After the high-school students completed their internship, they had to deliver a documentation paper. Based on these documentation papers and the feedback by the coaches, 10 laureates were chosen and honoured during a final meeting of all Summer School participants in autumn 2004.

Most of the researchers involved in the GEN-AU programme had a very positive view of the Summer School irrespective of their engagement in the activity. A large number of researchers who supervised Summer School participants stressed that they put in a lot of effort and time but nevertheless were really enthusiastic about this initiative.

Despite this positive tenor some points of critique were also raised in our interviews: Some interview partners are convinced that 16 year old students are too young for laboratory work. Apart from that some supervisors would have liked “their” Summer School students to know more about the topic when entering the lab. Other researchers had concerns regarding the integration in the laboratories, the exposure to expensive equipment and the potential benefit for the students. Another point of critique is related to accounting issues. The amount of time supervisors spend with these issues is regarded to be out of proportion to the amount of money the students receive for their work.

One interviewee suggested that the accounting issues be outsourced by creating a centralized structure that is responsible for the employment of all Summer School students. Regarding the remuneration of the high-schools students, one interviewee suggested to make use of a bonus system to reward outstanding Summer School participants. Apart from that, the timing issue has been criticized and earlier announcements of the Summer Schools were reported to be necessary. Other interview partners were convinced that first-year university students would profit more from the training and that the laboratories would also profit more from them. Some interviewees also regretted that this interesting initiative gained little public attention due to a very limited response of the media. On average, the Summer School was rated at a value of 2.1 on a scale from 1 (very satisfied) to 5 (not at all satisfied). Summer Schools were thus ranked third among all GEN-AU aspects scrutinized in the scope of the online survey (see Graph 6).

[82] *bm:bwk* (2004): GEN-AU Summer School

Comments by the Evaluation Team

In general the Summer School is evaluated to be very positive. We therefore suggest sticking to the concept of the Summer School. We also suggest to sticking to high-school students as the target group in order to meet the goals of the activity. Turning to Austrian university students might not be a good idea because all university studies follow very specialised curricula (in contrast to, say, a US college which – in the first years – offer a broad range of subjects in order to foster general education). As a result, GEN-AU would only reach students who have already decided to study genetic engineering (or a related subject in the natural sciences for that matter). We further suggest keeping the voluntary status of supervisors.

Nevertheless some issues could be addressed:

- Participation in the GEN-AU Summer School is in great demand. We therefore suggest expanding the initiative.
- The knowledge status of the Summer School students may be increased by providing general information packages on genetics and genomics that allow the Summer School participants to gain deeper insights into these topics than is possible at school. Maybe also a 1-2 day introductory course for all participants would be of value. In addition, supervisors may be asked to provide more information on the project the high-school students will be working on.
- Regarding public attention of the Summer School, more efforts need to be put into PR activities. Stimulating participants to get more into contact with the media is a starting point but not enough. A strategic media cooperation would be beneficial.
- Regarding accounting issues we suggest considering a centralized structure to employ the Summer School students in order to reduce indirect project costs and to shift them away from the supervisory scientists.

6.3.2 GEN-AU Mobility Programme

This instrument aims at PhD students and Post-Docs who are involved in one of the GEN-AU projects. The GEN-AU Mobility Programme should facilitate collaboration with leading international research institutions or research programmes. Austrian PhD students and Pos-Docs have the possibility to learn new methods and techniques. Those participating in the Mobility Programme are intended to bring back the acquired skills and know-how to Austria and apply them in the GEN-AU project. Per project the costs of two Post-Docs for one year each are calculated for the Mobility Programme. Participants out of cooperative projects, pilot projects, associated projects and networks have to stay abroad for at least 6 months and at most 12 months; students out of ELSA-projects have to stay 3 months minimum and 12 months maximum. After returning, the participants in the Mobility Programme are obliged to submit a final report on their work abroad.[83]

The project leaders suggest participants, and the Scientific Advisory Board approves them. In addition to the grant (€ 22,540 p.a. for PhD students, € 37,330 p.a. for PostDocs), a subsidy for accommodation and partial travel costs is made available.

In the first period of the GEN-AU programme 7 PhD students and 3 Post-Docs participated in the Mobility Programme. Four out of the 10 participants were involved in an ELSA project.

[83] *bm:bwk* (2003): Mobilitätsprogramm GEN-AU

Most of the researchers involved in GEN-AU perceived the possibility of taking part in the Mobility Programme as very positive and noted the importance regarding young researcher's careers. In addition, the unbureaucratic handling of the Mobility Programme has been complimented.

Nevertheless, there has been one point of critique voiced by many interviewees: the duration of the stay. Some argued that there are quite a number of schemes available that allow medium-term stays (thus suggesting that GEN-AU might at least partly duplicate existing instruments) and that there would be little available on the short end and on the long end of the time scale. For the short end, nearly all interviewees suggested reducing the minimum time to be spent abroad to three months for all project types. A further reduction does not seem advisable as misuse for "conference tourism" would probably increase visibly.

On the other end of the time scale, one might consider the idea of "independent grants." Independent grants (which need not be necessarily mobility grants) could be designed in such a way that they are associated with GEN-AU projects but at the same time offer longer term perspectives. This instrument could be used by either doctoral students (the rationale behind this would be that a thesis cannot be completed within a timeframe of two years) or by post-docs in order to give them impetus on their path to independence.

In addition some interview partners suggested also funding visiting scientists who bring in knowledge needed in GEN-AU projects.

Comments by the evaluation team

The evaluation team regards the Mobility Programme of GEN-AU as a successful measure to support young scientists. We recommend reducing the minimum duration of stays to three months for all project types. In addition, the idea of "independent grants" (longer-term grants, that are associated with GEN-AU projects, for doctoral candidates and post-docs) could be considered. Apart from that we also suggest providing GEN-AU researchers with information on existing arrangements for the promotion of visiting scientists.

6.4 Female Executives: Gender Issues in GEN-AU Projects

There are different strategies to increase the percentage of female executives in science. Generally speaking, it is necessary to address the individual as well as the structural and cultural dimensions. On the individual level these are normally monetary or non-monetary individual furtherance instruments of various types. These instruments serve the purpose of direct support and furtherance of female scientists in the research field. However, to bring about long-term change, it will be necessary to break down structural barriers. In the framework of research programmes these structural barriers can be overcome by means of design, content, and objectives as well as acceptance criteria. This means, that in programmes that promote science (as well as technology development), the following flanking measures could be appropriate: network structure (information-events, focused speeches and invitations, promotion of women's networking activities), furtherance of careers (mentoring or coaching of next generation executives), provision of specific platforms and opportunities to build-up and develop specific skills, composition of project proposals or the consultation of female first applicants. Furthermore, measures within the award procedure (predefinition of project quotas (female quotas amongst project submitters, project managers...), a bonus-system for a special share of women, nomination of women within the tender panel, revision of existing acceptance criteria and its re-evaluation so as to equalize success rates of men and women)) are further possible steps.

The promotion of women in leading positions is a clearly stated goal of GEN-AU. The programme management wants to achieve this goal by introducing the request for gender mainstreaming strategies in project funding. In phase II of GEN-AU also a bonus system for female executives has been announced.

In the course of GEN-AU, gender-sensitive wording has been implemented in the official documents.[84] Gender issues have not been incorporated in the first call for cooperative projects, but so far comprise a project evaluation criterion in all following calls. According to the solicitation documents[85], it is expected that research teams show a balanced composition of women and men (or special percentage of women if no equal distribution is possible) and that, if relevant, gender specific questions have to be addressed separately. Research personnel and project leaders shall tend to correspond to the goal of the EU to reach a 40 % quota of women. Wherever this is impossible, comprehensible arguments are required (as missing experts).

In any case, we do not think that a 40 % quota is a realistic goal and would suggest instead a relative quota. In addition, it was announced that a bonus system for female executives would be published on the Webpage of GEN-AU. However, up to now no such information has been provided at the GEN-AU webpage.

Table 19 Women and men in leading positions of GEN-AU projects

Project type	Number of projects	Project leaders			Project managers			Subproject leaders		
		sum	m	f	sum	m	f	sum	m	f
Cooperative projects	4	4	4		3		3	24	22	2
Networks	2	2	2		2	1	1	11	10	1
Pilot projects	6	8	8		3	1	2	25	21	4
Associated projects	5	6	5	1	0	0	0	6	6	0
ELSA	6	6	4	2	0	0	0	4	2	2
Sum	23	26	23	3	8	2	6	70	61	9

Source: GEN-AU, adapted by Joanneum Research

In Table 19 the numbers of women and men in leading positions of projects in phase I of GEN-AU are given. Please note that a project can have more than one project leader and a subproject more than one subproject leader. In this calculation each project has at least one subproject leader that is the project leader. Projects are not required to have a project manager.

The number of female project leaders is very low, as there are only three of them. Two female project leaders head ELSA projects, one is leading an associated project. Only a slightly higher proportion of women has been calculated for the subproject leaders. Except for associated projects, all project types have at least one female subproject leader.

In the case of project managers - who are said to be mainly concerned with administrative issues - the ratio of females to males is completely different. 75 % of the project managers are female, only 25 % are men.

Because of the constant and massive changes in the project employee structure reported by the GEN-AU office no analysis of other project members, e.g. young scientists, could be carried out.

In the last few years, a certain awareness of the situation for female executives in science (GEN-AU seems to reflect this situation quite well) has emerged. There are a whole array of different promotion schemes, initiatives and PR-activities in Austria, most of them coordinated by fFORTE: Femtech, DOC-forte, FIT, ‘Lise Meitner’ and ‘Herta Firnberg’, etc. At least some of these activities suffer from weak budgets. For reasons of synergy, we suggest not to add a new

[84] Compare *bm:bwk* (2001a) with *bm:bwk* (2004a)

[85] *bm:bwk* (2004a)

special scheme to the GEN-AU activities, which promotes female executives, but rather to check cooperation possibilities with existing programmes.

Conclusions and recommendations

➢ *The GEN-AU office should inform those who work in GEN-AU projects about the possibilities of existing promotion schemes, like femtech within fFORTE. These initiatives should be made visible: one can think of an information booth during an evaluation conference, links on the GEN-AU webpage or articles in the GEN-AU email newsletter.*

➢ *The GEN-AU office should screen possibilities of close co-operations with existing initiatives (e.g., DOC-FFORTE): GEN-AU could think of financing one or two scholarships that are selected by the SAB and located in a GEN-AU project.*

➢ *The GEN-AU office should think of using "role models" in its public relation activities, not only externally (programme folder, web page, etc.), but also internally (evaluation conferences, newsletter, etc.).*

➢ *Prizes are a popular instrument to guarantee public awareness of role models: If GEN-AU is planning a 'GEN-AU prize' for female scientists, it should put effort into making this prize visible. One possibility might be a co-operation within ERA-net to set up an international prize in the field of genome research. This means that the winner is not automatically an Austrian female citizen and does not necessarily work in a GEN-AU project. Making the prize international would make it more visible and distinguishable from other initiatives.*

➢ *Usually, women are less well connected and in fewer networks than men. So, an ambitious female scientist who wants to apply for a network or a cooperative project with (new) partners will have to do more networking and will spend more time in contacting people than established (male) scientists. It is necessary that they have enough time for preparing their proposals – therefore we recommend longer time spans for GEN-AU calls.*

➢ *One other option could be to implement financial reward schemes for senior researchers/ officials who hire qualified female personnel. Results of this measure in the US in connection with performance-based pay are promising.*

➢ *The use of quotas was criticized by some of our interview partners. Rather, they argued for a "level playing field." Also they offered, for example, the idea of providing sub- or smaller projects with substantial autonomy for women who are just finishing their training to run -- with mentoring provided but with the project being run outside the traditional hierarchy.*

6.5 Venture Capital

Development of employment levels in the life sciences in Austria will have to rely heavily on private investment in start-ups. Thus, activities of private investors will certainly influence whether GEN-AU meets its employment target figures and goals. It has to be noted, however, that GEN-AU, being a programme focussed on basic research and scientific quality, cannot and should not become an active player in the (private) equity (PE) and venture capital (VC) market for biotech or life sciences companies. There are other schemes available for this purpose (e.g., the seedfinancing programme of the aws). The purpose this chapter is thus only to inform on the current and relevant investment climate situation in Austria, in order to provide a complete picture of the setting GEN-AU is embedded in.

The importance of VC or PE as a form of financing for biotech firms arises from the fact that after initial investments for founding the company have been made a considerable amount of money is still needed to develop a marketable product.[86] Development of market-ready biotech products is lengthy (particularly due to the amount of testing needed), and the chance of failure is great, both of which turn biotech investments into risky undertakings. Initial funds are unlikely to suffice and traditional forms of finance (bank loans, access to capital markets) are almost certainly not available.

Goodman and *Stolis* identified and quantified three major benefits of using VC for biotech companies: VC accelerates innovation (product development can be up to three times faster if VC is used), it allows high risk projects to be carried out (hence, products can be developed that otherwise would not make it to the market) and it has a multiplier effect (many founders or even more employees of start-ups found other biotech companies, too, once their first start-up has proven to be successful).

The Austrian market for VC/private equity has been traditionally small.[87] The amount of risk capital totals 0.1 % of GDP in Austria as opposed to 0.4 % for the whole of the EU. Countries where venture capital is popular show shares of venture capital soar as high as 1.5 % of GDP (USA and Iceland). On average, Austrian companies rely heavily on bank loans, which account for 60 % of the used financial sources. 45 % of the enterprises have a negative equity ratio.

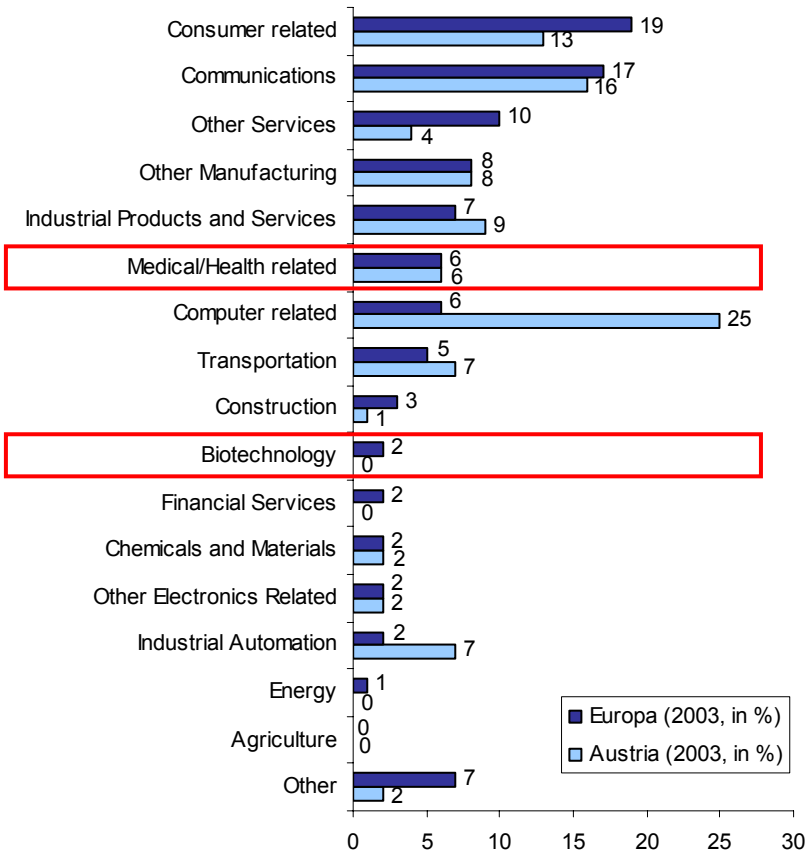
Because of new regulations (BASEL II treaty, amendments to tax laws, newly established pension funds in Austria, etc.), the venture capital market has, however, started to boom in the past years, almost quadrupling in volume from € 61 million in 1997 to € 235 million in 2000. Consequently, Austria has caught the attention of many international private equity companies. 2001 turned out be a difficult year for the VC scene, once the biotech bubble had burst. The market volume slumped to € 138 million but has been slowly recovering since.

In 2003 relatively little money was invested in biotechnology in Europe. In Austria there were almost no venture capital funding activities recorded for 2003. However, some transactions concerned the health related medical field: 6 % of European as well as Austrian venture capital money went into this area in 2003. Two things have to be kept in mind. First, that this figure is only a snapshot of the current situation. VC money has flowed into the Austrian biotechnology scene and is likely to flow again in the future. Secondly, a lot of Austrian companies are at least partially funded by VC money from abroad (acquired worldwide), most of which will not show up in Graph 14.

[86] *Stolis/Goodman* (2004, p. 9ff)

[87] *Austrian Business Agency* (2003, p. 6ff)

Graph 14 Venture Capital investments, by sector



Source: EVCA Yearbook 2004

With respect to VC, the offerings of aws have to be certainly mentioned. aws provides funds for the seed and pre-seed financing stages, guarantees for equity stakes, etc.

7 Case Studies – Four Selected GEN-AU Projects

This chapter portrays four GEN-AU projects in greater detail. The purpose of this chapter is to make GEN-AU more tangible and to allow the reader to have a closer insight on the different project types, their network structure, their work and their tasks.

7.1 Cooperative Projects

"Epigenetic Plasticity of the Mammalian Genome"	
Aim of the project:	The project is aimed at analyzing the epigenome of the mouse and creating a corresponding index. As mice share a lot of similarities with humans, results should be also of high value to humans.
Place/ Coordination	**Research Institute of Molecular Pathology (IMP)**
Funding and Running Time	€ 3,453,446 for 36 month
Contact	**Thomas Jenuwein**

In this cooperative project five research groups combine their expertise for epigenetic research on the murine genome. Epigenetic information refers to the chromatin structure that adds an additional layer of information to genetic information. The overall epigenetic features of a cell is called "epigenome" and can be stably inherited.

The research groups concentrate on the biology of epigenetic control by investigating the plasticity of gene expression and differentiation of related cells, by analyzing differences in chromatin structure with its impact on cell differentiation, genome stability and tumour development. This GEN-AU project will develop an "epigenetic map" of the mouse genome by comparing the chromatin state of large chromosomal regions between stem cells and differentiated cells, using genomic micro-arrays.[88]

In brief, the project set out to analyse the murine epigenome and create a corresponding index. Results from this model system are expected to be easily transferable to humans. The development of this "epigenetic index" promises new starting points for the diagnosis and treatment of abnormal cell development (cancer), a better understanding of the nature of stem cells, and new insights into the secrets of old age.[89]

Partnering institutions:

The following partner institutions contribute to the cooperative project

- *CeMM – Center of Molecular Medicine GmbH:* The centre was founded as an institute of the Austrian Academy of Sciences (ÖAW) for creating a close connection between basic research and clinical research.
- *IMP – Research Institute of Molecular Pathology GmbH:* Founded in 1985 and located at the Campus Vienna Biocenter, IMP is a centre of excellence in molecular biology and genetic research. The IMP conducts basic research and is sponsored largely by the pharmaceutical company Boehringer Ingelheim. It employs a staff of over 200 people from 28 countries.

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[88] http://www.imp.univie.ac.at/genau/genau_descr.html, Mar 2, 2005

[89] http://www.gen-au.at/projekt.jsp?id=12, Mar 2, 2005

- *Institute of Molecular Biochemistry*: IMB is located at the Campus Vienna Biocenter and is a department of the Medical University of Vienna.

The cooperative project is made up of five **subprojects**:

- *"Epigenetic elements involved in genomic imprinting"*
  - Project leader: Denise P. Barlow
  - Institution: CeMM – Center of Molecular Medicine GmbH
- *"Epigenetic transcriptional control in early lymphopoiesis"*
  - Project leader: Meinrad Busslinger
  - Institution: IMP – Research Institute of Molecular Pathology GmbH
- *"Regulation of Chromatin structure by histone methyltransferases"*
  - Project leader: Thomas Jenuwein
  - Institution: IMP – Research Institute of Molecular Pathology GmbH
- *"Regulation of gene expression by reversible acetylation"*
  - Project leader: Christian Seiser
  - Institution: Institute of Medical Biochemistry, Medical University of Vienna
- *"RNA protein interactions in chromosome-wide x-inactivation"*
  - Project leader: Anton Wutz
  - Institution: IMP – Research Institute of Molecular Pathology GmbH

The project in the context of GEN-AU

The research team believes that the GEN-AU programme provides an optimal design and support structure because of its long-term orientation. This is also the reason why a proposal was submitted. The biggest strength of GEN-AU is, according to the scientists, the amount of grant given and the long running time. IMP is also coordinating a European Network of Excellence on a related issue. Consequently, IMP tries to foster international cooperation and integrates international research groups also in its GEN-AU project. The research team believes that the GEN-AU funding scheme can be considered superior to the European Networks of Excellence (NoeEs) in many ways. In particular, about the same amount of money as in the NoEs is available for fewer researchers and for a longer period of time. In addition, much less coordination work is needed as all personnel are located at the IMP premises in Vienna.

The researchers felt comfortable with the whole proposal selection procedure and, in particular, with its cost-saving two-step approach. The annual evaluations are basically regarded to be positive; especially the possibility to prepare presentations efficiently was mentioned. The interview partners suggested that the results of the two evaluations be written down in a more sophisticated way and, in addition to the German version, English versions should be prepared. The research team believes that it would be beneficial to extend the duration of the annual evaluation conferences. Two days would be supposedly ideal to provide for enough time for discussion with the SAB and with other GEN-AU participants. According to the interviewees, it is imperative that the GEN-AU scientific advisory board consist of more international members. GEN-AU as a programme of excellence should be thoroughly subjected to international assessment. Furthermore, it would be beneficial if the board members had more expertise regarding the topics of the funded projects.

Accompanying measures

With regard to the mobility programme, the researchers pleaded for more flexibility, especially as more short time visits are needed. The research teams did not take advantage of the current scheme because the minimum period of stay is by far too long for apprehending certain scientific methods deemed important for this project. Nevertheless, there have to be measures in place to support researchers in the very long run. In particular, it was suggested to create long-term positions for the participants in order not to force them to leave and go abroad after

some time. As of now, the mobility scheme focuses only on medium term stays, and medium-term mobility schemes are abundant in Austria. The experiences with the Summer School, three out of the five labs coached pupils, were mixed. In the interviews it was stated that the pupils should have a better scientific background which should be verified in advance by the organisers.

Two researchers out of the whole project attended the discourse days. They noted that only people who were really interested went there because time and location (too peripheral) were not well chosen. Thus a discourse with the public did not really take place. A further point of critique is the focus on a German speaking audience only. The existence of ELSA is considered to be a positive point although some topics seem to be too far fetched. Other than that, little contact exists to ELSA researchers, and it was suggested to use ELSA results more to market GEN-AU.

The general PR measures that are in place are, according to the scientists, novel for Austrian research programmes and certainly a good idea for getting the scientific messages across to the general public. The research team suggested that more emphasis be placed on TV and radio broadcasts that aim at an audience interested in science. Furthermore, the webpage should be updated more frequently, especially the English part. The internal section (for project participants only) is rarely used.

Overall impression and conclusions

- The project has been set up because of the long-term perspective of GEN-AU and is long-term orientated.
- The project exhibits close collaboration between all researchers; this is said to be linked to the location of all groups at the Campus Vienna Biocenter.
- Within the research teams of this cooperative project there is a strong demand for a more international orientation of GEN-AU.
- Consequently, there is a desire to use the English language much more frequently in the scope of GEN-AU.
- This cooperative project is a good example of a working cooperation between a commercial company, the science community and a government programme. It draws its strength from four factors: the long running time, the relatively high amount of funds available, the reputation of the institute and its researchers and the fact that clearly arranged research groups are working together in close proximity, thus avoiding too much coordination work.

7.2 Pilot Projects

TISSUE – a comprehensive disease bank for functional genomics	
Aim of the project:	Create a comprehensive tissue bank meeting highest quality and legal criteria, and ensure that information will be made available to a wider scientific community.
Place/ Coordination	**Med. University Graz**
Funding and Running Time	€ 1,087,136 for 36 months
Project leader	**Kurt Zatloukal**

High throughput technologies gained in importance over the last ten to twenty years. Connected with these techniques are libraries storing different kinds of biological material, be it DNA, RNA, proteins, bacteria, cell lines, tissue samples, etc. These libraries and high throughput technologies allow following a new approach in research that is screening a huge number of probes in a very short time frame and generating comparable and reproducible results. Large data sets are generated and stored in databases that require bioinformatic analyses for interpretations. Via such an approach it is possible to speed up research on the one hand and on the other hand to generate results researchers had not been looking for in the first place.

Libraries and storage banks often exist only once for a certain topic, and the "content" of the libraries often can be ordered for further investigations by researchers around the world.

Within the **TISSUE project** one of the world's largest disease banks with more than 3 million tissue samples has been established. A sophisticated database with clinical and experimental data relating to the samples has also been set up. Besides, the researchers aim at developing a new production process for tissue-micro-arrays, as well as new therapy concepts for the treatment of liver and breast cancer, and chronic liver inflammation caused by diabetes mellitus, alcoholism and adipositas.

Partnering institutions[90]

- Institute of Pathology Med. Univ. Graz, Kurt Zatloukal, Helmut Denk
- Institute of Virology, University of Veterinary Medicine Vienna, Walter Günzburg
- Institute of Cancer Research, Med. Univ. of Vienna, Rolf Schulte-Hermann, Bettina Grasl-Kraupp
- Med. University-Hospital Graz, dept. internal medicine, Michael Trauner
- Oridis Biomed GmbH, Charles Buck

The Oridis Biomed GmbH is closely connected with the Institute of Pathology as Kurt Zatloukal is CEO of the company that has been founded in 2001. In addition, the mission and activities of the company are closely connected with the GEN-AU pilot project. Especially the robot to produce tissue micro-arrays is a crosspoint.

[90] according to *http://www.gen-au.at*

The project is made up of the following sub-projects[91]

- Disease bank core facility (Inst. of Pathology, Med. Univ. Graz)
- Human cancer xenograft models for testing of innovative therapies (Inst. of Virology, University of Veterinary Medicine Vienna)
- Human cancer-derived culture models for functional gene characterization (Inst. of cancer research, Med. Univ. of Vienna)
- Integration of clinical and experimental data (Med. Univ.-Hospital Graz)
- Standardised gene expression analysis platforms (Oridis Biomed GmbH)

The Project in the context of GEN-AU

Originally the team (together with others) applied for a **cooperative project**. The heterogeneity in its experimental part has been mentioned as the reason for rejection by one of our interview partners. However, the evaluation panel is said to have seen a great potential in the proposal's main part dealing with a tissue bank. In order to keep this promising and unique idea the project team was encouraged to adopt the proposal to a mode that was called "pilot project". The core element of the proposal is said to have persisted; restructuring processes (which were conducted by the ministry together with the project leader) are described as relatively unbureaucratic and efficient.

Overall impression and conclusions

- With four scientific partners and one spin off as industry partner, the pilot project is quite large, and there does not seem to be a huge difference between it and the cooperative projects. However, the funding volume of this particular pilot project is in the range of a third of the average funding volume of cooperative projects.
- The project leader plays a quite powerful role in GEN-AU, not only in the design of the project or in the day-to-day business, but also in the phases of project adoption and contract negotiation.
- The phases of contract negotiation seem to be crucial for the set-up of the project.
- Several problems were mentioned that occurred in the starting phase of GEN-AU (e.g., financial issues), but it was stated that these were solved in the meantime by the GEN-AU office.
- Heterogeneity in attitudes: We have learned from the interviews carried out for the case study that there were different attitudes among the project participants about selection processes and underlying motivations. This refers to the questions why such a type of project was chosen, who selected the projects and how they were selected. We conclude that there may be a lack of information or lack of transparency about these procedures.

[91] "Co-ordination" is defined as a separate sub-project on the GEN-AU homepage, but not included in this list.

7.3 Networks

BIN – bioinformatics integration network	
Aim of the project	To provide an environment for building bioinformatics capabilities in Austria, i.e. support GEN-AU and future genomic initiatives at academic institutions by establishing a bioinformatics infrastructure
Place/ Coordination	**Technical University Graz**
Funding and Running Time	€ 1,733,952 for 36 months
Project leader	**Zlatko Trajanoski**

The network belongs to the field of bioinformatics. On the one hand this research field is necessary in the context of GEN-AU to analyze the huge amounts of data produced using high throughput technologies such as sequencing or microarray analyses. Without bioinformatics it would be impossible to analyze the generated data appropriately and in due time. On the other hand the data is used for the creation of theoretical models, for the prediction of structures and functions of biomolecules, etc.

The bioinformatics integration network (BIN) is active in both areas described above. There are parts that can be regarded as more service-oriented and parts that try to build and improve theoretical models.

The BIN-project pursues the following four **main objectives**[92]:

- Establishment and maintenance of bioinformatics services, research, networking, and support for commercialization;
- Establishment of connections across multiple information resources, such as data on genomics, proteins, and clinical medicine, as well as across multiple disciplines, including mathematics, statistics, physics, computer science and life sciences, by using an Open Source platform for freely available source code;
- Establishment of a national virtual laboratory to accelerate the pace of life sciences knowledge discovery by providing new ways of viewing and analyzing biological data, facilitating research and understanding of databases from both technical and biological perspectives; and
- Training of highly qualified personnel through
  - development of new study plans,
  - incorporation of bioinformatics into existing curricula, and
  - assistance for postgraduate scientists.

[92] Compare as well the project specific information given at http://www.gen-au.at/

Partnering institutions[93]

- Institute for Genomics and Bioinformatics, TU Graz, Zlatko Trajanoski (A)
- Tyrolean Cancer Research Institute, Reinhard Kofler (B)
- Research Institute of Molecular Pathology (IMP), Frank Eisenhaber (C)
- Institute for Theoretical Chemistry and Structural Biology, Univ. of Vienna, Peter Schuster (D)
- Institute for Chemistry, Univ. of Graz, Christoph Kratky (E)

These partners (identified by the letter designations above) carry out bioinformatics services and database integration (B), in silico target identification and prediction of functions (C), and work on computer-aided structural genomics (D, E). The project is coordinated by Zlatko Trajanoski (A). His home scientific institute is also central in achieving the goals of the project.

Not all partnering institutions receive money from GEN-AU.

As stated above, BIN is also active in the education of researchers. Special workshops are organized to communicate special bioinformatics methods and their applications to biologists and other scientists primarily in the context of GEN-AU. In addition, scientists at the PhD level are instructed and conferences organized.

The Project in the context of GEN-AU

The field of bioinformatics is quite new in Austria and still in its infancy.[94] It is a field that is of growing importance in other countries, notably the US. Some of the BIN-project partners were originally embedded in an application for a coordinated project. After the reviewing process, the SAB recommended the extraction of the parts dealing with this topic and the establishment of a bioinformatics network. Thus a new formation of partners emerged.[95] A new proposal was submitted, and the project started with some delay in January 2003.[96] BIN scrutinizes and carries out storage, management and analysis of biological information generated/used within the GEN-AU projects. In particular, BIN supports the work carried out within the cooperative projects of GEN-AU by a number of activities, such as providing information, services and training. Another important merit of BIN is the integration of researchers from different fields and thus different scientific cultures. Regular formal and informal meetings are said to take place. In this way, the project is believed to have led to an increased understanding among the different scientific communities.

The project has been positively evaluated by the SAB after its first year. The SAB, however, also noted that duplications on an international scale should be avoided in one of the subprojects. In addition, the integration of another subproject has been noted to be in need of improvement.

Members of the research team are also formally involved in a number of additional GEN-AU projects. Thus, it was possible to use GEN-AU in order to establish tight connections with groups the team did not work with before and to intensify existing contacts.

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93 according to *http://www.gen-au.at/*

94 Information obtained during the interviews. There has been only one professorship of bioinformatics in 2004. The need for additional support in this field has been detected by the Vienna Science and Technology Fund that decided to fund two group leader positions in bioinformatics at the end of 2004.

95 One should bear in mind the recommendation of the SAB to include national stakeholders in the field.

96 The corresponding reviews have not been made available to us.

Overall impression

The field of bioinformatics is recently gaining major importance. By integrating bioinformatics, GEN-AU addresses one of the latest issues in life science's research. The establishment of this network project led to several benefits, most important the greater efficiency of work in related GEN-AU-funded projects. Thus, an important support structure could be established, whose success mainly depends on the enthusiasm of its "network-affine" project leader. Bioinformatics recently has become more and more important for research in life science. Hence, it seems worthwhile to extensively support this field, and apply the generated results (improvement of this technology) in other contexts. These steps might enable Austrian research to catch up with international standards in genomics. Network projects, if they are able to create valuable links between participating researchers, as it is the case for BIN, should be provided with a continuous flow of financial support. For this reason, an extension of funding in GEN-AU or by other schemes might be reasonable.

7.4 ELSA Projects

LET'S TALK ABOUT GOLD – Analysing the interactions between genome research(ers) and the public as a learning process	
Aim of the project:	The project aims at understanding learning processes going on when bioscientists and the general public meet. The GEN-AU cooperative project GOLD serves as an example.
Place/ Coordination	**University of Vienna,** **Department for Social Studies of Science**
Funding and Running Time	€ 306,687 for 36 months
Project leader	**Ulrike Felt**

Societal controversies concerning issues of science and technology, particular in terms of genetics, increased in recent years – especially in Austria (e.g., referendum in 1997). Purely expert-oriented models of dealing with social and ethical issues in these domains have started to be questioned. To render the relationship between this scientific domain and society more stable, a better understanding of the way everyday people position themselves towards this kind of research, how they perceive the social and ethical issues that are at stake and, in particular, how gender and the fact of being directly affected impinge upon these positions, is needed.[97]

The project is aimed at developing a new form of communication between the biosciences and the public and takes the cooperative project GOLD[98] as an example. The first and central data source for the ELSA-project is the **model of the "round table"**. It was developed in Switzerland and follows the principle of letting a group of lay-people accompany a bigger research project or topic over a longer period of time. In the case of the ELSA-project a group of 12-14 persons, who have no direct connection to genome research, meets regularly over a period (approximately one year) with researchers working on the GOLD-project to discuss different aspects of the research under the guidance of a moderator.[99]

Further **aims of the ELSA-project** are[100]

- to point out potential consequences of genome research at an early moment and in succession to render possible a societal discussion;
- to analyse the ways in which everyday people develop and express their positions towards a broad variety of social and ethical issues linked to this research;
- to provide a framework in which gender related perceptions are better framed in the debate and can be better understood in their different effects;
- create a space where potential users (affected people) can feed back their expectations and experiences into the research process; and
- contribute to an enlarged vision of social and ethical issues linked to the field of genome research.

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97 http://www.gen-au.at/projekt.jsp?id=37, Feb 7, 2005

98 Full project title: „GOLD – Genomics of Lipid-Associated Disorders, new genes and molecular mechanisms for lipid and energy metabolism and related diseases". The goal of this project, managed by Prof. R. Zechner at the University of Graz, is to discover and explain the function of each gene and protein involved in the process of uptake, storage and mobilization of lipids (fats) by cells.

99 *VIRUSSS* (2003, p. 12)

100 *VIRUSSS* (2003, p. 15)

For this ELSA project an international Scientific Advisory Board was created, which is composed of three external experts (one ethicist from Germany, one sociologist from Switzerland and one researcher in the field of social studies of science from the United Kingdom). This kind of scientific exchange will be done several times throughout the project. Up to this point, the meetings with the board were considered to be cooperative and fruitful.

Institutions and researchers carrying out the project

The project is led by Ulrike Felt from the Department for Philosophy of Science and Social Studies of Science at the University of Vienna. The department has two main lines of research related to (techno)science and its development. One is investigating internal factors of scientific development and one is dealing with questions of science and society. The latter (Vienna Interdisciplinary Research Unit for the Study of Science and Society – VIRUSSS), which is carrying out the ELSA-project, aims to foster critical and reflexive debate with scientists and students from all disciplines, but also with a wider public, concerning issues surrounding the developments of science, technology and society. Gender relevant aspects are seen as a central topic to be treated in this framework. Furthermore, the researchers of VIRUSSS offer expertise and know-how in particular in the domain of science - public interactions and questions related to science policy.[101] Since its very beginning the department has developed very strong international contacts and has run a number of national, international and European projects over the years.

The **ELSA-project** is carried out by **VIRUSSS** together with the Inter-University Research Centre for Technology, Work and Culture – **IFZ** in Graz.[102]

The project in the context of GEN-AU

VIRUSSS became involved with GEN-AU because it had already dealt with issues concerning public participation and the methodical approach of the round tables. Furthermore, the bm:bwk and VIRUSSS were in contact as the research institute carried out the evaluation of the first discourse day organized in the context of the GEN-AU programme. After several discussions with Prof. Rudolf Zechner of the cooperative project “GOLD”, which was already running at that time, the decision on the collaboration between the cooperative project and the ELSA-project was reached.

The team of the research unit regarded the application process for the ELSA-project as clear and comprehensive and attached importance to the bottom-up approach. Nevertheless, they added that the whole procedure was designed with the natural sciences in mind. For instance, the application forms and also the standard contracts were said to clearly show this. The project assessment was perceived as transparent. The researchers regarded the two-stage application mode as very positive. Other favourable aspects were that they have been provided with feedback on the short proposal as well as external reviews.

Other issues concerning the GEN-AU programme which the ELSA-researchers look upon favourably are the communication with the programme management and the webpage.

Within the project two researchers of the unit made use of the mobility programme, each spending 4 months to experience research at two foreign institutions. The team of researchers is convinced that the support of mobility is extremely important and regarded it as very positive to exchange experiences with researchers working on similar issues. The handling of the mobility programme on the part of the GEN-AU office turned out to be unbureaucratic. Concerning the time frame of such temporary employments abroad, the project team perceived three to four month to be appropriate for social scientists.

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[101] http://www.univie.ac.at/virusss, Feb 7, 2005

[102] http://www.ifz.tugraz.at/index_en.php/article/articleview/5/1/2, Feb 8, 2005

In case of the Summer School, the interviewee pleaded for the possibility of individual decisions at the level of a particular researcher. The Summer School is regarded as an important initiative especially for integrating students into the natural sciences GEN-AU-projects. It is less important for ELSA-projects because of the direct link to genome research (e.g. laboratory work).

One suggestion for improving the programme was the definition of "integrated project proposals" targeted at collaboration between the social and natural sciences. However, the ELSA-researchers argue that the possibility of applying together or separately be left open. In general the whole programme process hitherto is considered to be positive and satisfying by the ELSA-project team.

Overall impression:

- This project is the only ELSA project that exhibits formal linkages to a natural science GEN-AU project and is a proof that researchers in the natural sciences can fruitfully collaborate with researchers in the social sciences.
- Prof. Felt, holding a doctoral degree in theoretical physics, is also an example of a person with qualifications and expertise both in the natural and social sciences. She thus fits a profile that is – according to the views of many of the interviewed experts – considered to be extremely beneficial for conducting ELSA research.

7.5 Conclusions

In order to address different aspects of research, GEN-AU has established different types of projects, as described in this chapter. While conducting the interviews and reviewing project-specific information, the following issues for an improvement of the programme were raised:

- All GEN-AU timelines should be communicated early enough and consistently.
- Timeframes to submit project proposals should be extended.
- Application forms should be designed in a project-specific way.
- More focus should be placed on internationality. Cases in point are the availability of GEN-AU documents in English and a more international composition of the SAB.

The primary benefits of GEN-AU arise from the high funding of the projects, the long running time, the relatively small research groups and the fact that the researchers work together at the same premises, thus lowering coordination efforts.

The attempt to connect life-science-research with social science can work well, as proven by Prof. Felt's project. In addition to the independent call for ELSA-projects, this issue can be tackled by allowing ELSA sub-projects within the cooperative projects of GEN-AU.

According to the network projects, the following should be born in mind: Valuable linkages need time to establish and structural settings should stabilize to a certain degree, in order to produce additional benefits to related projects. Networking also needs additional resources (time and money) for a lively and fruitful co-operation. For this reason it is important to identify future funding possibilities. If good network projects are to be dropped after the three years of GEN-AU funding, public resources spent are most likely misallocated or even wasted.

8 International Comparison

In this chapter international approaches for the support of genomic research are outlined. Valuable insights into the most important schemes for three nations (the USA, Canada, and Japan) are provided. The purpose is to inspire the GEN-AU management to further improve the programme's design and functioning. Additionally, special light is shed on different attempts of a number of nations to foster the integration of ethical, legal and social aspects of genomics research (ELSA).

8.1 U.S. Funding Programmes in Genomic Research

There are multiple government grant programmes in genomic research in the U.S. The most notable in terms of size is operated by the National Institutes of Health. The Department of Energy is next in size. The Department of Defense also funds research in the field. The Small Business Innovation Research Programme (SBIR) and the Advanced Technology Program (ATP) are public-private partnership programmes that have provided grants to businesses for genomic and proteomic research. Though smaller, the ATP may be particularly noteworthy because it operated a focused public-private partnership programme in genomics research, with similarities to GEN-AU.

8.1.1 The National Institutes of Health's National Human Genome Research Institute

The largest research funding programme in the field in the US is operated by the National Institutes of Health's National Human Genome Research Institute (NHGRI). Recent funding levels for NHGRI are given in Table 22.[103]

Table 20 NHGRI Funding FY 2003-2006 (millions of USD)

Allocation	FY 2003	FY 2004	FY 2005	FY 2006 Estimate
Total, NHGRI	USD 465.0	USD 490.5	USD 488.4	USD 491.0
Research project grants	114.1	112.7	115.6	117.8
Research Centres	214.5	218.8	219.4	219.4
Other Research	12.3	11.4	12.0	11.8
Training	7.2	7.9	7.6.	7.6
R&D Contracts	12.8	17.4	16.6	15.5
Research Mgmt & Support	11.9	14.8	17.5	18.0
Total, Human Genome Support	372.8	383.0	388.6	390.0
Intramural Research	92.2	107.5	99.8	101.0

The NHGRI solicits grant applications that relate to scientific priorities and research interests. For some programmes, the NHGRI participates with other Institutes and Centers (IC) at NIH. All NIH solicitations are published weekly in the NIH Guide for Grants and Contracts[104]. The archive can be browsed or searched by keyword. NHGRI also accepts innovative research proposals not specified by the solicitations, and it encourages investigators with novel ideas to discuss potential applications with programme staff and submit these applications for competitive review.

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[103] Information about NIH-sponsored genome research is available at *http://www.genome.gov*.

[104] *http://grants.nih.gov*

NHGRI's currently announced programme areas include the following:

- Sequences, Maps and BAC Libraries Programme

The Genome Sequencing Programme is responsible for the administration and support of research directed to the highly efficient construction of physical maps, large-scale sequencing and genomic resource production for entire genomes.

- Genetic Variation Programme

The Genetic Variation programme supports research on genetic variation and how it relates to diseases, responses to drugs, and environmental factors.

- Genome Technology Programme

The Genome Technology programme supports research to develop new methods, technologies and instruments that enable rapid, low-cost determination of DNA sequence, SNP genotyping, and functional genomics (broadly defined) experiments. The programme also supports and coordinates transfer of technology from developers to users, and promotes collaborative, multidisciplinary programmes that closely integrate research projects at academic and industrial laboratories.

- Functional Analysis Programme

The Functional Analysis of the Genome programme manages and supports research that will lead to improved techniques and strategies for efficient identification and functional analysis of genes, coding regions and other functional elements of entire genomes on a high throughput basis. The main emphasis is technology development. Supported technologies must be efficient, robust and have the potential to be applied in a large-scale yet cost-effective manner. The programme also supports the large-scale application of high-throughput and efficient technologies on a limited basis, primarily in model organisms.

- Genome Informatics and Computational Biology Programme

The Genome Informatics programme supports research in computational biology that will enable the development of tools for sequence analysis, gene mapping, complex trait mapping, and genetic variation. These tools include mathematical and statistical methods for the identification of functional elements in complex genomes; the identification of patterns in large datasets (for example, microarray data); and the mapping of complex traits and genetic variations (for example, single nucleotide polymorphisms, or SNPs). The programme also encourages development and maintenance of bioinformatics resources that will allow the scientific community efficient access to genomic data.

- Ethical, Legal and Social Implications (ELSI) Research Programme

Since 1990, NHGRI has operated an Ethical, Legal, and Social Implications (ELSI) Research Programme. ELSI funds and manages research studies on the ethical, legal, and social implications of genomic research, and supports workshops, research consortia and policy conferences related to these topics. NHGRI's ELSI programme is the largest supporter in the U.S. of this kind of research.

- International HapMap Project

The haplotype map, or "HapMap," will be a tool that will allow researchers to find genes and genetic variations that affect health and disease. The HapMap should make genome scan approaches to finding regions with genes that affect diseases much more efficient and comprehensive. In addition to its use in studying genetic associations with disease, the HapMap should be a powerful resource for studying the genetic factors contributing to variation in response to environmental factors, in susceptibility to infection, and in the effectiveness of and adverse responses to drugs and vaccines.

- Centers of Excellence in Genomic Science

The Centers of Excellence in Genomic Science (CEGS) programme establishes new academic centers for advanced genome research. Each CEGS grant supports a multi-investigator, interdisciplinary team to develop innovative genomic approaches to address a particular biological problem. A CEGS project will focus on the development of novel technological or computational methods for the production or analysis of comprehensive data sets, or on a particular genome-scale biological problem, or on other ways to develop and use genomic approaches for understanding biological systems. Each CEGS will nurture genomic science at its institution by facilitating the interaction of investigators from different disciplines and by providing training of new investigators, expanding the pool of professional genomics scientists and engineers. The formation of new groups of investigators to conduct genomic research is particularly encouraged, and CEGS Planning Grants are offered.

- The ENCODE Project

ENCODE (short for Encyclopedia Of DNA Elements) is a public research consortium open to all academic, government, and private sector scientists interested in participating in an open process to facilitate the comprehensive interpretation of the human genome sequence and who agree to the criteria for participation. The three-phase project aims at identifying all functional elements in the human genome sequence. The process involves close interactions between computational and experimental scientists to evaluate a number of methods for annotating the human genome.

NHGRI plans for new initiatives are expressed in the NIH Roadmap report, *A Vision for the Future of Genomics Research* -- the result of almost two years of discussion involving over 600 scientists. Three major areas of focus are identified in the plan: Genomics to Biology, Genomics to Health, and Genomics to Society. The International Haplotype (HapMap) Project, the Encyclopedia of DNA Elements (ENCODE), and the NIH initiative on Molecular Libraries and an Ethical, Legal and Social Implications (ELSI) Center initiative are projects already underway to help achieve the vision.

NIH’s grant application process consists of a two-step peer review to determine eligibility for funding. The NIH’s Scientific Review Branch manages the initial peer review process for a wide variety of grant proposals assigned to the National Human Genome Research Institute (NHGRI), including research programme projects. The Genome Research Review Committee conducts the review of these proposals to evaluate their scientific and technical merit.

Following completion of the initial peer-review process, NHGRI-assigned proposals receive a second level of review, conducted by the National Advisory Council for Human Genome Research (NACHGR). The NACHGR advises the U.S. Department of Health and Human Services (DHHS), the National Institutes of Health (NIH), and the National Human Genome Research Institute (NHGRI), on genetics, genomic research, training and programmes related to the human genome initiative. NACHGR performs second-level peer review for grant applications, and determines the programme priorities for NHGRI and the goals for the government's efforts in the International Human Genome Project (HGP). NACHGR meets three times a year. It has a working group, the Ethical, Legal and Social Implications (ELSI) Research Advisors (ERA), that provides advice and guidance to NHGRI on ethical, legal and social implications of genomic research.

8.1.2 The Department of Energy's Genome Programmes[105]

Following completion of the Human Genome Project, the Department of Energy (DOE) has initiated the **Genomics: GTL programme**. The GTL programme aims to use DNA sequences from microbes and other organisms as starting points for systematically tackling questions about the essential processes of living systems. The applications of this level of knowledge will help DOE fulfil its broad missions in energy, environmental remediation, and global climate change mitigation. Specific aims of the programme are the following:

- Develop methods for high-throughput automated genome assembly and annotation to characterize microbial functional diversity.
- Develop computational tools to support high-throughput experimental measurements of protein-protein interactions and protein-expression profiles.
- Develop predictive models of microbial behaviour using metabolic-network analysis and kinetic models of biochemical pathways.
- Develop and apply advanced molecular and structural modelling methods for biological systems.
- Develop the groundwork for large-scale biological computing infrastructure and applications.

A set of four linked research user facilities is planned in conjunction with the GLT programme: (1) a facility for production and characterization of proteins and molecular tags; (2) a facility for characterization and imaging of molecular machines; (3) a facility for whole proteome analysis; and (4) a facility for analysis and modelling of cellular systems and microbial community dynamics.

The GTL programme had approximately USD 10 million available for grants to be made in 2005. For two components of the programme (multi protein complexes and genetic regulatory network analysis), the funding level for individual research awards is approximately USD 1-6 million per year (total costs) for 3 to 5 years. For the third component (predictive model development), the funding level is approximately USD 1-2 million per year (total costs) for 3 to 5 years. The programme's call for grant applications is for "research from large, well integrated, multidisciplinary research teams that support the Genomics: GTL research programme." Researchers are invited to include, where appropriate, partners from multiple institutions, including DOE National Laboratories, universities, private research institutions, and companies.

Proposals to the GTL programme are subjected to formal merit review (peer review) and are evaluated against the following four criteria which are listed in descending order of importance:

- Scientific and/or technical merit of the project,
- Appropriateness of the proposed method or approach,
- Competency of the personnel and adequacy of the proposed resources, and
- Reasonableness and appropriateness of the proposed budget.

In addition, proposals are evaluated for the robustness of their organizational framework and coordination plan. The evaluation also includes programme policy factors such as the relevance of the proposed research to the terms of the announcement and the Department's programmatic needs. External peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers may be used.

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[105] For Information about DOE genome research see *www.science.doe.gov*, *http://doegenomestolife.org*, *www.sc.doe.gov/ober/microbial.html* and *www.jgi.doe.gov*.

8.1.3 National Science Foundation Funding in Biosciences

The National Science Foundation (NSF) is another notable source of grant funding for genome research in the U.S., through its Biological Sciences programmes. NSF funds in broad research topic areas, making it relatively easy for genome researchers to find funding opportunities.

NSF's budget for support of biological sciences for 2005 is approximately USD 577 million, from which between 2,500 and 3,000 awards will be made, and the proposed 2006 budget is USD 582 million. At USD 118 million in the 2005 budget, Molecular and Cellular Biosciences accounts for the largest component of NSF's biological sciences budget.

Total grant size ranges from USD 5,000 to nearly USD 5 million. The average award duration for research grants is 3.2 years. NSF supports varied activities that provide the infrastructure for contemporary research in biology. Funding areas include plant genome research, microbial genome sequencing, and genomes and genetic mechanisms in all organisms, plus others.

NSF uses merit review with outside peer evaluation as a cornerstone to its proposal review system. NSF programmes obtain external peer review by three principal methods: (1) "mail-only," (2) "panel-only," and (3) "mail-plus-panel" review. In addition, site visits by NSF staff and external peers are often used to review proposals for large facilities, centres, and systemic reform initiatives. NSF Programme Officers are given discretion in the specific use of review methods, subject to supervisory approval. Since 1991 the percentage of NSF proposals reviewed by panel-only has increased from 40 to 46 percent of all proposals. During the same period, there has been a steady decline in the use of mail-only review from 30 to 17 percent. The use of mail-plus-panel review increased from 31 to 38 percent during the past ten years.

8.1.4 Defense Advanced Research Projects Agency (DARPA)

DARPA is the central research and development funding organization for the Department of Defense. It focuses on research the armed services are unlikely to support because of high risk. DARPA uses a top-down process to define problems and a bottom-up process to find ideas.

DARPA has a strategic initiative in the life sciences, call "Bio-Revolution." The initiative aims to mine the discoveries coming out of the life sciences for concepts and applications that could enhance U.S. national security, such as to thwart the threat of biological attack. DARPA's bio-revolution thrust includes genomics and proteomics, cell and tissue engineering, biocomputations, and bioinformatics, among other topics.

The approach to accomplish its mission is to provide a forum for evaluation of competing scientific and technological ideas. DARPA typically uses industry briefings to outline problems within a specific technology area and to request submission of technical solutions to these problems. All potential offerers are provided with identical information and have equal opportunity to respond. Information on these industry briefings is published in the *Commerce Business Daily*. DARPA holds a systems and technology symposium approximately every 18 months to communicate to industry the agency's priorities for future programmes. Also, from time to time the agency holds conferences to discuss topics that include the academic and scientific communities.

DARPA solicits R&D work through advertising. A DARPA project requires: good technical ideas, contractors who can do the work, customers for the programme results, a sufficient budget, and a programme manager. Many DARPA solicitations encourage a white paper or pre-proposal submission, to which DARPA programme managers give feedback. Proposals are reviewed by the DARPA programme manager and additional procurement officials according to evaluation criteria set forth in the solicitation. Selectable proposals are examined for potential impact on achieving the DARPA programme goals. DARPA uses contracts, grants, and "innovative agreements and other transactions" to channel support as needed to carry out basic, applied, and advanced research projects.

8.1.5 Small Business Innovation Research (SBIR) Programme[106]

The SBIR programme is among the largest of U.S. public-private partnership programmes. It is a set-aside programme to fund small businesses to provide research and develop new processes and products in support of government missions. There are 11 federal agencies that administer SBIR programmes, but five of the 11 – DOD, NIH, NASA, DOE, and NSF - account for 96 % of SBIR funding. DARPA, which itself operates one part of DOD's SBIR operations, for example, has an SBIR with an estimated annual budget of USD 45 million. The DOD SBIR programmes alone fund a billion dollars in early stage R&D projects at small technology companies each year.

The agency SBIR programme that is most active in funding in the genomics/proteomics research area is the NIH SBIR programme. Of NIH's 27 institutes and centres, 23 participate in the SBIR programme. The following topics are from a recent NIH solicitation of SBIR grants: DNA sequencing, human genome sequence variation, comparative genomics, functional genomics, bioinformatics and computational biology, bioinformatics education, ELSI studies, and other research topics. Again, all SBIR funding at NIH and the other agencies is specifically designated for research grants to small businesses. In contrast, the bulk of NIH funding goes to academic institutions.

In considering the scientific and technical merit of each SBIR application, the following criteria are used by NIH: (1) Significance, (2) Approach, (3) Innovation, (4) Investigators, and (5) Environment, where each criterion is supported with a list of three-to-five questions. Each agency has its own criteria, but they all relate back to the mission and goals established in SBIR programme legislation.

8.1.6 Advanced Technology Program (ATP)[107]

Started in 1990, the ATP is a public-private partnership programme located in the Department of Commerce and administered by the National Institute of Standards and Technology. From 1990 through 2004, the ATP provided more than USD 2 billion for more than 700 cost-sharing awards to business-led research projects in all sectors of the economy. The funding was competed in peer-reviewed competitions. Funded projects were in electronics/photonics (25 %), information technology (23 %), advanced materials and chemistry (21 %), biotechnology (20 %), and manufacturing (11 %).

Despite an uncertain future, the ATP may be of particular interest for comparing with the GEN-AU programme, because it operated a **DNA Diagnostics Focused Programme** from 1994-1998, on a similar scale to GEN-AU.[108] The programme was developed with input from industry, academia, and other government agencies. A white paper process was used that helped produce the technical and business goals for the focused programme. Like other focused programmes conducted by the ATP, the programme in genomics was to have a limited duration, and, like all project funded by ATP, the projects funded would have well defined goals and set time lines.

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[106] Information on the SBIR may be found at www.sba.gov/sbir, in several reports on the SBIR programme published by the National Academy of Sciences, National Research Council, which is currently assessing the SBIR, and at the websites of the individual agencies that administer SBIR programs.

[107] Information on the ATP may be found at www.atp.nist.gov.

[108] ATP's focused programme in Tools for DNA Diagnostics is described in *ATP Working Paper Series, Working Paper 04-01*: "Catalyzing the Genomics Revolution: ATP's Tools for DNA Diagnostics Focused Program."

The focused programme's technical goal was to develop methods for sequencing, interpreting, and storing DNA sequences, with an emphasis on automation, miniaturization, ease of use, and low cost. These advances would allow a patient's DNA sequence to be rapidly determined and made available for use by a physician. ATP was creating through the focused programme what has become known as "pharmacogenomics."

The focused programme's business goal was to create a technological base that would enable the development of an industry in DNA diagnostics. To make this happen, goals were to increase speed of tests by a factor of 10 and to decrease cost from the 1994 price of USD 100 per test to USD 1 to USD 10 per test.

As the programme got underway, it was observed that the technologies for diagnostic applications could also have a major positive effect on speeding the Human Genome Project, then underway. ATP's programme received substantial support from Dr. Francis Collins, head of the Human Genome Project at NIH, as well as from other experts in DNA analysis in NIH, DOE, and other agencies involved in the field. They saw ATP's programme as complementary to programmes funded by these other government agencies.

ATP DNA focused programme held competitions in 1994, 1995, and 1998, with money specifically earmarked by programme management for this purpose. It committed USD 99 million to fund 26 multi-year projects. Additional projects in the same topic area were also funded through ATP's open competitions.[109] These projects in genomics/proteomics from the open competitions numbered 16 through 2002, and the funding commitment level was an additional USD 39 million. All of the funded projects lasted approximately from two to a maximum of five years for a joint-venture project.

Proposers had the option of submitting a pre-proposal for feedback prior to submitting a full proposal. The projects in ATP's focused competition were selected using a peer review process that featured in parallel both a technical review by scientists who were experts in the field, and a business review.[110] The business review was conducted by business and financial experts and economists who considered the likelihood that a proposed project had a viable path from the laboratory to the market and a large potential payoff for society if it were technically and commercially successful.

ATP's focused programme in genomic research appeared to have stimulated the submission of proposals to the ATP in the topic area, in that the number of submissions increased with the on-set of the focused programme. Benefits claimed for the programme include substantial reductions in the cost of SNP analysis, reductions in the cost of sequencing a base pair of DNA, and a speeding of the human genome time line. According to an ATP working paper, the focused programme also played a formative role in establishing the U.S. biochip industry. Indeed, ATP funded several start-up companies that went on to become leading companies in the industry. There is substantial evidence that ATP may be credited with major advances in the field; however, ATP's focused programme in DNA Diagnostics has not yet been subjected to rigorous impact assessment.

Neither ATP's focused programmes nor have the open competitions had goals that called out special encouragement to women or minority scientists or young scientists. Furthermore, ATP has not funded social science research in ELSA-like projects. It has held a large number of workshops and conferences open to the public, but these were not aimed primarily at encouraging general public discourse on science to promote public understanding. The normal application of its selection criteria, however, has resulted in funding some projects run by

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[109] From 1990 to 1994 and after 1998, the ATP ran only open competitions without focus on particular topic areas. From 1994 through 1998, while it was running its focused programs with pre-selected topics, it also continued to use a small share of total funding to continue running open competitions.

[110] More recently, ATP has used a stage-gate review process, where first a proposal is reviewed for its technical merit. If it passes, the proposer submits a business plan for review.

women-owned and minority-owned companies, and many start-up companies run by young people. And, although businesses are in the lead in ATP-funded projects, numerous universities participate in them. Fostering collaboration is an important ATP goal, and it is reflected in the projects funded, most of which involve multiple participants.

8.2 Canada: Genome Canada

"Genome Canada" is the major Canadian initiative in the field of Genome Research, established by the federal government in spring 2000.[111] Genome Canada is a not-for-profit corporation, located in Ottawa (Ontario), dedicated to developing and implementing a national strategy in genomics and proteomics research for the benefits of all Canadians. As the primary funding and information source it has received about CAD 435 million[112] from the Canadian Government[113] and additional funding from other sources like industry to coordinate genomics and proteomics research in the following key areas:

- agriculture
- environment
- forestry
- fishery
- health
- bioinformatics
- genomics ethics, environmental, legal and social issues (GE³LS)
- development of new technologies
- science and technology platforms

Initiative	**Genome Canada** www.genomecanada.ca
Duration	2000-2004, 2005-2009
Governmental Budget	CAD 435 million (appr. € 271 million) till 2004
Mission	Genome Canada is a not-for-profit corporation dedicated to developing and implementing a national strategy in genomics and proteomics research for the benefit of Canadians

Genome Canada initiates and effectively manages a major nationwide programme in genomics research by establishing the necessary infrastructure as well as by funding research projects considerably larger than in other Canadian research programmes. Therefore Genome Canada has established five Genome Centres and an innovative, business-oriented programme model that could shift the research culture at universities[114], formerly accustomed to smaller more independently managed research projects, towards large-scale research with a predefinition of firm milestones and deliverables. Besides it promotes international collaboration in the field of genomics as well as research projects analyzing the ethical, environmental, economic, legal and social issues related to genomics research. The Genome Canada Board of Directors is composed of 15 members from industry and the scientific community. The Board of Directors is assisted by the Science and Industry Advisory Committee that provides strategic advice to

[111] All information presented here, was obtained from the website of Genome Canada http://www.genomecanada.ca/GCgenomeCanada/enBref/index.asp?l=e
[112] appr. € 271 million
[113] CAD 375 million for the first three years and an additional amount of CAD 60 million in 2004
[114] The majority of the funded projects are university-based.

ensure that the corporation achieves its long-term objectives of excellence and leadership in selected areas of genomics and proteomics research.[115]

Genome Canada's main objectives are:

- increased interactions, partnerships and collaborations between organizations
- establishment Genome Centres to provide leading edge technology and training
- incremental research projects that are based on Canadians strengths and expertise
- adequate and effective management of S&T platforms
- leadership in GE³LS
- effective communications and outreach programme
- increased participation in international genomics research
- increased investment in genomics research by others
- socio-economic and industrial benefits to Canada

To date three national competitions (calls) were organised. The first competition required proposals for the establishment of regional Genome Centres in combination with associated large-scale research projects and relating S&T-platforms seen as necessary for carrying them out. That is, the large-scale research projects plus the supportive platforms were viewed as the proposed research programme of a regional Centre. In the end five Genome Centres were established.[116] In April 2001, Genome Canada announced its first investment (Competition I) of CAD 136 million[117] to support 17 large-scale research projects and five science and technology platforms across the country.

In July 2001, Genome Canada announced the beginning of a second national competition. Competition II aimed at funding several large-scale genomics research projects and their related science and technology platforms. Results of Competition II were announced in April 2002 and CAD 155.5 million[118] was invested in 34 innovative and exciting research projects. Just as the first call the second call had no specific guidelines regarding the type of projects or the desired area of research.

The last call had its focus on Human Health due to a mandate of the federal government concerning the funding conditions.

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[115] The detailed Terms of References of the Advisory Committee can be found at http://www.genomecanada.ca/GCgenomeCanada/SIAC/index.asp?l=e

[116] The Genome Centres are located in the following cities: Vancouver, Calgary, Toronto, Montréal and Halifax

[117] appr. € 85 million

[118] appr. € 97 million

The selection process can be described as follows:

Table 21 Genome Canada's project evaluation process

Step 1
Genome Canada issues a call for proposals, including descriptions, guidelines and evaluation criteria, as well as specific timelines.
Step 2
The Genome Centres established by Genome Canada publicize it and researchers can access the application forms via the Centres' websites.
Step 3
The researchers then develop their proposals usually in consultation with the Centres.
Step 4
Pre-Screening of the proposals is provided by the Centres, sometimes with assistance of a scientific advisory board. Then a selection of proposals is forwarded to Genome Canada.
Step 5
At Genome Canada the proposals are analysed by management experts with respect to budgetary and management aspects. Some proposals are rejected at this stage, some are sent back to the researchers for revision.
Step 6
The remaining/ revised proposals are reviewed by an international panel of scientific experts in a strict peer review process, where each proposal is assigned to a minimum of three to four panel members, who prepare detailed written reports on the projects. The process is usually accompanied by hearings of the researchers involved in a project.
Step 7
The Board of Directors of Genome Canada approves the proposals that were recommended for funding by the expert panel.

More than CAD 800 million (approximately € 499 million) has been distributed to 79 innovative research projects and sophisticated science and technology platforms so far.

Genome Canada set up an **International Consortium Initiative** and signed international agreements with several countries, also in Europe, for funding international genomics research projects. As a result of the Framework Agreement to Promote Scientific and Industrial Corporation between Canada and Spain signed in 2002, a first joint competition of Genoma Espana and Genome Canada was held in 2003. Genome Canada is also part of the CAD 95 million (approximately € 59 million) Canadian-led Structural Genomics Consortium (SGC), which is an international partnership with the UK focusing its efforts on determining the three-dimensional structure of more than 350 human proteins. Genome Canada is also involved in the following two other major international initiatives:

- The Haplotype Map project: A CAD 150 million (approximately € 94 million) programme with contributions from the US, UK, Japan, China, Canada and others to identify repetitive gene associations within the human genome.

- The Bovine Genome Sequence project: A CAD 53 million (approximately € 33 million) US international effort to sequence the bovine genome, including also researchers from Australia and New Zealand.

There are **no explicit measures** within the Genome Canada programme **to support next generation scientists**, since this target group is usually integrated in the funded large-scale projects and in additional specialised training courses for young scientists that are provided through the five operating Genome Centres. However, there are several activities taken by Genome Canada to promote science to young Canadians: Partnerships with the Youth Science Foundation Canada and other key players are established and various science awards in the field of genomics sponsored. Besides, an extra webpage area addressing young Canadians has been established together with Genome British Columbia and the Canadian Museum of Nature, giving information on several fields of interest.[119]

ELSA = GE³LS: There is a separate part of the programme dedicated to the analysis of ethical, environmental, economic, legal and social issues related to genomics research. Five main research projects were funded with a budget of CAD 8 million (approximately € 5 million). The mid term evaluation of the Genome Canada programme observed that the activities resulted in a perceived international leadership of Canada in this field. In Competition I (first call) three projects were granted with a total budget of CAD 6.1 million (approximately € 3.8 million). In competition II (second call) two projects got funded with an overall budget of CAD 2 million (approximately € 1.2 million).

8.3 Japan: Biomolecular Research Programme and Genome Network

Despite several initiatives promoting genetics that were undertaken by the Japanese Government during the 1980s and 1990s, the field of genomics research in Japan was sad to be far behind international expertise. That is why in 1998 the Genome Research Programme started and was accompanied by the establishment of the Genomic Science Centre, thereby giving an international signal. This effort called Genome Frontier Programme later renamed Biomolecular Research Programme, has an intended run-time of 10 years and is an inter-ministerial Programme, funding human genome's research. The Programme has been supported by the Science and Technology Agency (STA) and the Institute of Physical and Chemical Research (RIKEN).

Initiative I	Biomolecular Research Programme (formerly called Genome Frontier Programme)
Duration	1998-2008
Governmental Budget	JPY 50 billion (appr. € 300 million) for the first 5 years
Mission	Boost Japanese Genome Research to a leading position and excellent expertise, gaining international recognition

After long lasting discussions about the design of the Programme, it was finally carried out as originally planned, that is focussing on three parts: DNA base sequencing using full-length mouse complementary DNAs (cDNAs), the analysis of the human genome using chromosome 21 and the analysis of protein function and structure. For this purpose in the year 2000 an additional Biomolecular Research Centre was built in Yokohama, near Tokyo, and about 200 researchers were recruited. RIKEN also hoped to recruit 20 to 40 external researchers to participate in the project through a collaborative research system, and intended to accept proposals from overseas researchers in related fields. The first five years have been approved by the government with a planed total investment of ¥ 50 billion (approximately € 300 million) for this period. In the programme's first year a sum of ¥ 4 billion has been spent. The Sequencing of full-length cDNA was carried out using the latest automated high-speed sequencer developed by RIKEN, called RISA, for producing a genetic 'encyclopaedia' of gene and protein functions.

[119] for detailed information compare http://www.genomeeducation.ca/GEindex2.asp and the given links.

Some leading genomic researchers claimed that the project is too ambitious because Japan was "several years behind the West" in genome research.[120]

Initiative II	Genome Network
Duration	2004-2008
Governmental Budget	JPY 15-billion (approximately € 102 million)
Mission	Support the collection of data on all human genes by promoting a systematic, comprehensive analysis of the human genome.

One of the latest efforts taken by the Japanese government to promote human genome research is the "Genome Network". This governmental five-year JPY 15-billion (approximately € 102 million) initiative enables researchers to systematically analyze the function of all human genes. It is supported by the Ministry of Education, Culture, Sports, Science and Technology of Japan. The project aims at four targets: (i) analysis of genome information; (ii) development of genome analysing technology; (iv) analysis of individual life functions; (v) establishment of human genome network platform. RIKEN is again playing a major role in the project as well as the National Institute of Genetics of Japan. They also invite research proposals from universities which would be granted after the selection process.

The initiative will collect experimental data on all 30,000 human genes. The Genomic Sciences Center (GSC) in Yokohama will play a central role within this initiative, but Japan's science ministry will divide the work among researchers across the country. Details still remain to be decided. Like the US Encyclopedia of DNA Elements (ENCODE) project, the Japanese Genome Network project aims at a systematic, comprehensive analysis of the human genome. Japan's project will focus on how the information in the genome is expressed. It will look at the interaction between genes and the proteins known as transcription factors that initiate the expression of these genes. The collections of cDNA held by Hayashizaki's centre and by Sumillion Sugano of University of Tokyo's Institute of Medical Science are already among the largest in the world. The project hopes to enlarge these collections and wants to assemble a library of complementary DNA corresponding to every human gene. The initiative began at a national level but may entail collaboration with projects in other countries later on.[121]

8.4 ELSA: Looking Beyond Borders

Research on the ethical, legal and social/societal aspects (ELSA) of genomics is reported to be not only small in scale, but also strongly fragmented between countries and scientific disciplines.[122] In order to enhance quality and quantity of this research and to achieve synergy and convergence within Europe, the Netherlands Genomics Initiative has taken the lead in creating an ERA-NET in this field. In the forefront, an international survey of national programmes for research on ELSA of genomics research in the EU Members States, Associated States, Canada and the United States has been carried out.[123] This report enables us to look beyond borders for activities in ELSA research.

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120 *Nature* (1998),Vol. 392, Mar 19, 1998, p. 219

121 http://www.nature.com/news/2004/040531/pf/429332b_pf.html

122 *Beer/Jansen (*2004)

123 *Beer/Jansen (*2004)

The survey differentiates between

- Countries with special programmes for ELSA of genomics research with funding possibilities for specific ELSA research centres
- Countries with special programmes for ELSA of genomics research but without funding possibilities for specific ELSA research centres
- Countries with special programmes for genomics without an earmarked budget for the ELSA of genomics research
- Counties without an earmarked budget for ELSA of genomics research but with specific attention to and relevant experience in ELSA of genomics research
- Countries with some experience in ELSA on genomics research
- Countries without ELSA of genomics research but with a few ELSA activities
- Countries without ELSA of genomics research

Tables 22-24 give an overview of the countries belonging to the above mentioned groups.

The Netherlands and the United Kingdom are among of the most interesting countries to look at if it comes to ELSA research. Both are reported to run special programmes for ELSA and also created centres for ELSA research.

Three centres for genomics and society were funded with this in 2002: Centre for Economic and Social Aspects of Genomics (CESAGEN), Centre for Social and Economic Research on Innovation in Genomics (INNOGEN), Centre for Genomics in Society (EGENIS). CESAGEN is based at the universities of Lancaster and Cardiff. The centre focuses on the transformation of knowledge production, economics and innovation, ethics and regulation, identity and social organisation, risk and responsibility as well as global discourse and cultural capital. INNOGEN is based at the University of Edinburgh and The Open University and works on providing a sound base for decision-making in science, industry, policy and public arenas. INNOGEN also stimulates the interaction of scientists, industry and private interest groups, policy makers and regulators, and citizens and public interest groups. EGENIS is based at the University of Exeter and focuses on language and meaning as the key terms from genomic science diffuse into other areas of expertise and the general public In addition research on the development of intellectual property law is carried out.

A large number of countries provide special money for ELSA research on genomics within dedicated programmes. In addition to Austria Canada, Finland, Germany, Hungary, Norway, Sweden and the US use this strategy. The USA was the first to address ethical, legal, and social issues that may arise from genome research.

There are also countries that run special programmes on genomics but without special budgets for ELSA research. Bulgaria, Estonia, France, Lativa, Spain, Luxembourg, Romania are cases in point. Other countries are reported not to carry out ELSA research at all or only to a limited extent.

Some of the above mentioned countries (e.g. Germany, Hungary) include discourse activities and professional communication with the public in their ELSA initiatives. Finland for example also clearly states that one aim of is ELSA activities is to improve public perception of research.

Table 22 **ELSA activities in various countries - Countries with Special Programmes for ELSA of Genomics Research with Funding Possibilities for Specific ELSA Research Centres**

Country	Activities
The Netherlands	In 2001 the Netherlands Genomics Initiative (NGI) that is affiliated with the Netherlands Organisation for Scientific Research (NWO) has been established. NGI is funded by five national ministries of the Dutch government: Education, Culture and Science; Economic Affairs; Agriculture, Nature management and Food Quality; Health, Welfare and Sport; Spatial Planning, Housing and the Environment. NGI has a budget of € 300 million for 7 years that, among other purposes, is used to establish Centres of Excellence. 5 % of the budget of these centres go into research on ELSA of genomics. In addition, there is a special programme called "The Societal Aspects of Genomics" and a Centre for Society and Genomics (CSG). CSG was established in September 2004 with a budget of € 8 million for four years.
United Kingdom	The Economic and Social Research Council has created a Genomics Network. This network allocates € 12.5 million for 10 years to a "systematic critical and technically informed exploration of the past, present and future economic and social trajectory of genomics". Three centres for genomics and society were funded with this in 2002: Centre for Economic and Social Aspects of Genomics (CESAGEN), Centre for Social and Economic Research on Innovation in Genomics (INNOGEN), Centre for Genomics in Society (EGENIS). Besides there is also the ESRC Genomics Research Forum that exploits synergies across these three major research centres and beyond and will develop new research links and activities. In addition, a survey on attitudes towards genomics is carried out and three small projects lasting for 12 months are funded. There is also a postgraduate forum on Genomics and Society.

Source: Beer/Jansen (2004) as well as selected programme web pages; adapted by Joanneum Research

Table 23 **ELSA activities in various countries - Countries with special programmes for ELSA of genomics research but without funding possibilities for specific ELSA research centres**

Country	Activities
Austria	Since 2001 the Austrian Federal Ministry of Education, Science and Culture (bm:bwk) runs the Genome Research Programme GEN-AU. For the first three years, € 33.5 million have been available. The total funding volume is expected to be € 100 million for 9 years. In 2003 a call for proposals concerning ethical, legal and social aspects of genome research was launched. 6 social science projects receive € 1.5 million. GEN-AU is also active in public awareness initiatives and offers mobility fellowships for young researchers.
Canada	In 2000 Genome Canada was created. The programme receives about USD 435 million. (appr. € 272 million) from the Canadian Government. Genome Canada has a special part on analyzing the ethical, environmental, economic, legal and social issues related to genomics research (GE3LS). 5 research projects are funded with $ 8 million. (€ 5 million). In addition, there is an annual symposium organized for this field. A newsletter and editorial articles available online are included as well.
Finland	The Academy of Finland launched a Research Programme on Environmental, Societal and Health Effects of Genetically Modified Organisms (ESGEMO). The programme runs from 2003 to 2008, and for 4 years € 3.5 million has been provided by the Academy of Finland and several ministries. Currently 10 projects are carried out.
Germany	The German Ministry of Education and Research (BMBF) funds several programmes concerning genomics and one autonomous programme for the promotion of ELSA-research. € 4.5 million are provided for research on the ELSA of molecular medicine. The programme has been announced in 2001 and runs from 2002 to 2005. 3 cooperative projects and 14 individual projects are funded. In addition, there is also a junior researcher group on ELSA in the context of brain research and various discursive activities.

Source: Beer/Jansen (2004) as well as selected programme webpages; adapted by Joanneum Research

Table 24 **ELSA activities in various countries - Countries with Special Programmes for ELSA of Genomics Research but Without Funding Possibilities for Specific ELSA Research Centres**

Country	Activities
Hungary	The National Office of Research and Technology runs the Hungarian Biotechnology Programme. One of its 8 priorities (2003) concerns communication, effects of biotechnology and moral issues.
Norway	The Research Council of Norway has two programmes addressing ELSA of genomics. ELSA Norway runs from 2002 to 2007. In addition, 5 % of the budget of the Functional Genomics Programme (FUGE) is dedicated to ELSA research. FUGE runs from 2003 to 2007 and has a yearly budget of NOK 150 million (€ 18,3 million).
Sweden	The Swedish Foundation for Strategic Research funded the "ELSA in Sweden" programme that ended in 2003. Besides, the Wallenberg Foundation funds the Postgenomics Research and Technology Programme in Southwest Sweden (SWEGENE) where 18 scholars at 7 Swedish universities address bio-ethical problems.
United States	The US Department of Energy (DOE) and the National Institutes of Health (NIH) launched the Human Genome Project in 1990. In the programme it has been an objective to address ethical, legal and social issues (ELSI) that arose from the project. 3 % to 5 % of the budget of the Human Genome Project with USD 2.532,2 million. (€ 1.944,9 million.) of funding went into ELSI. A large number of research projects have been carried out. NIH continues to support ELSI research.
Countries with special programmes for genomics without an earmarked budget for the ELSA of genomics research	
Bulgaria, Estonia, France, Lativa, Spain, Luxembourg, Romania	
Counties without an earmarked budget for ELSA of genomics research but with specific attention to and relevant experience in ELSA of genomics research	
Belgium, Denmark, Iceland, Israel, Switzerland	
Countries with some experience in ELSA on genomics research	
Czech Republic, Italy, Poland, Turkey	
Countries without ELSA of genomics research but with a few ELSA activities	
Greece, Ireland	
Countries without ELSA of genomics research	
Cyprus, Liechtenstein, Lithuania, Malta, Portugal, Slovakia, Slovenia	

Source: Beer/Jansen (2004) as well as selected programme web pages; adapted by Joanneum Research

8.5 Conclusions

There are several approaches to supporting genomics research. Some of them were exemplified in more detail in the international comparison above. Despite national differences there are some notable aspects of accordance:

- Most of the programmes are managed by an agency or institute especially established for that purpose (like Genome Canada or the NHGRI in the USA).
- Most of the programmes follow a long term approach with sound planning, i.e., at different points in time key players (programme management, government, research community) discuss and agree on strategic plans. Thus, the programme's future development is outlined in corresponding documents, made publicly available.
- Most support schemes are based on co-operative research, i.e., major parts of funding are distributed to (often interdisciplinary) teams of researchers either from the public or the private sector or a combination of both.
- Programmes can gain from global expertise if they are set in an international context. One way to achieve this is to establish a lose co-operation among programme managers of different countries in terms of exchanging their experiences. Another possibility is to open national calls for foreign institutions/researchers. By doing so, the researchers' (international) mobility increases as well as the scope of knowledge flows. In addition, international-agreements for co-operative (international) calls of tender can be established.

Another aspect worth mentioning is the possibility to increase public acceptance and visibility of genomics research by using a well-designed homepage. Genome Canada's web site provides a case of best practise. It not only gives important information on general aspects of genomic research, the specific sub-programmes and scientific insights, it also increases public awareness by providing transparent information on all genome-related facts.

ELSA

The international comparison shows a variety of possibilities regarding the positioning of ELSA research. Allocating a defined budget to ELSA research when funding a genome research programme can be considered as a common strategy for a large number of nations. Some countries even decided to combine such efforts in specific research centres.

Within GEN-AU, ELSA seems to have the status of a programme within a programme. The possibility to integrate ELSA subprojects in cooperative projects in the current call and a number of statements in our interviews point out that a higher level of integration of ELSA is sought. Therefore, we suggest conceiving ELSA not as a separate programme but as a project type. Nevertheless we recommend also reserving a special budget for accompanying research projects in the future.

Regarding the content of ELSA research we would like to point out that in some other countries ELSA research is strongly related to increasing the acceptance and understanding of the technology in question by the public. Austria and additional countries differentiate between ELSA research and PR activities. In our view this differentiation is justified and should be held up. It would guarantee that "serious" research is being done within ELSA and that ELSA will thus not turn into a simple marketing tool. However, stronger usage of ELSA research results by the organisations and units handling public relations is highly recommended and in line with the suggestions and wishes of the scientists working in the network, cooperative and pilot projects.

9 A Plan for Future Monitoring and Impact Analysis

The purpose of this section is to develop a plan that will provide support to the programme in preparing for future impact assessment. This section develops performance measures for GEN-AU that are keyed to the programme's goals and activities, and outlines an evaluation strategy. To monitor progress, it also identifies an array of performance measures of activities, outputs, and outcomes from which the programme may select useful indicators of progress towards longer-term impacts as well as inputs to impact assessment.

9.1 Challenges of Monitoring and Evaluating R&D Programmes

In developing and implementing a plan for monitoring and evaluating R&D programmes, one has to be aware of the distinct challenges that may be encountered, including the following:

R&D programmes, such as GEN-AU, are multi-year efforts that typically have their intended benefits realized only after a number of years have passed. This challenge requires an evaluation strategy with a multi-year focus.

The direct output of R&D programmes tends to be knowledge embodied in papers, data, patents, presentations, models, algorithms, research equipment and techniques, reference samples, processes, prototypes, and human capital – which must be taken up by others to convert to market-useful products, processes, and services in order to achieve those intended long-term impacts centred on international competitiveness, enhancement of health and environment, new job creation, and industry growth. Thus only an early portion of the R&D value chain lies within the direct control of the programme's managers while part of the programme's ultimate goals lie much further down the chain. This challenge requires an evaluation strategy that looks not only to activities carried out by the programme, but also to the actions of others who use the resulting knowledge.

The scope of interest of a public programme extends across all affected parties, requiring a much broader focus than the evaluation of private-sector investment decisions. This challenge requires performance measures expressed in terms of societal benefits and costs.

The types of long-term impacts of the programme are expected to be varied – new diagnostic tools, new treatments, new approaches to further research progress, new capabilities for innovation, business growth, jobs, improved international competitiveness, environmental benefits, and more. This diversity of impacts creates a challenge of evaluation method, requiring multiple methods and measures to best address a variety of questions.

Public R&D programmes do not function in isolation. There are typically a host of other public and private activities underway that may also be investing in and yielding effects similar to those targeted by the programmes. Impact assessment seeks not only to show downstream effect, but to demonstrate that a programme caused the effect. Proving attribution is very difficult, but it is a gold standard of impact evaluation. Showing cause and effect is a challenge that requires careful attention to developing a rigorous study design.

If future impact assessment is to be conducted prospectively, some or all of future impacts must be projected. Prospective analysis, in contrast to retrospective analysis which relies on the collection of empirical data, gives rise to many uncertainties and risks. For example, if it is not yet known if the research goals will be achieved or if the results will be implemented, there will be major uncertainties in the projection of future benefits and costs required for the impact assessment. To meet this challenge, it may be necessary to use risk assessment in the context of decision theory to build into the evaluation estimated probabilities of alternative levels of technical and market success and to express quantitative impact results in expected value terms. Conducting the impact assessment retrospectively will reduce risk and uncertainties in the analysis.

9.2 Evaluation Framework

It is recommended that the impact evaluation plan be conceptualized in a benefit-cost framework. It is recommended that benefits be measured in part quantitatively and in part qualitatively, using the most appropriate and feasible measures. The costs of the public programme are defined as comprising the cumulative programme budget, and the costs to society are defined as comprising the cumulative programme budget plus all estimated related costs incurred by others.

A programme logic model shows how the programme operates and identifies inputs, activities, outputs, outcomes, and impacts that are expected to result. The logic model in Graph 5 serves this function in the monitoring and impact analysis framework for GEN-AU.

The monitoring plan centres on selecting a feasible number of indicator metrics from each stage of the process leading to long-term impacts, i.e., three sets of indicator metrics – one for activities, one for outputs, and one for outcomes. Most of the indicators will be trendable, meaning that each year's metric can be plotted as a trend line over time to show change. Most of the suggested indicators will be presented both in absolute terms and as a ratio to budget or number of projects to improve comparisons. The indicators are selected to show efficiency or to signal progress towards achieving an important goal or impact; they typically do not directly comprise measures of the programme's long-term benefits, but may be useful in that assessment.

9.3 Answering Questions and Measuring Success against Mission and Goals

Both monitoring and impact analysis are geared towards answering questions. Implicit in each mission statement and programme goal is a question regarding programme performance, and implicit in each programme activity is an objective intended to serve the programme's mission and goals. Thus, a basic set of questions to be answered through evaluation can be framed by converting mission and goal statements into questions and a set of operational questions can be derived from the list of activities.

In fact, a basic principle of impact assessment is to measure against programme mission and goals. While unintended benefits may also be measured, a programme's success is decided by comparing its actual effects against those intended. Accordingly, the ultimate long-term, mission-derived questions concerning success of the GEN-AU programme are the following:

- Has GEN-AU strengthened genome research in Austria?
- Has it created a network of genome research in Austria?
- Has it improved international competitiveness of Austrian researchers and organizations in the field of genomics?

The Programme's goals, which are more detailed than the mission statement, allow us to develop a more detailed set of questions that get at programme success. The following are goal-derived questions regarding programme success:

- Has GEN-AU promoted science by boosting strengths, filling gaps, creating critical masses, and promoting internationalization?
- Has it created knowledge to enhance health and protect environment?
- Has it created new jobs?
- Has it promoted women to achieve senior positions?
- Has it built up human resources, and promoted young researchers?

- Has it promoted technology transfer and industry as indicated by the creation of patents and start-ups, the strengthening of existing companies, and promoting the industry in Austria?
- Has it increased public acceptance of life sciences?

Note that there is not perfect alignment between the mission statement and the statement of goals. Most notably, the mission speaks to creation of a network of genome research, yet an explicit goal that relates to network creation, such as fostering collaborative research relationships, is absent. However, the programme's funding of cooperative projects and networks directly provides a mechanism for accomplishing this aspect of the mission so it was not overlooked in the programme's design.

Also note that it is helpful to have performance standards for judging the degree of success achieved, but - as is the case with most comparable programmes - these are lacking in the GEN-AU Programme. Consider, as an example, the goal to create new jobs. A performance standard would set a jobs target for judging success. For instance, is it sufficient for success that the funded projects result in the employment of research scientists on funded projects, or is the creation of a specified number of new commercial jobs required for success? When there are no specified performance standards against which to assess programme success, the default approach is to state measured accomplishments against each goal - such as the number of research and production jobs achieved – and leave it to others to decide what level of success is represented by the stated accomplishment.

9.4 Monitoring Progress with Performance Indicators

The logic model provides a logical linkage between programme inputs, activities, outputs, outcomes, and long-term impacts. It shows us what to expect from start to finish. It suggests performance indicators at each stage that can signal progress towards desired long-term impacts. From the model we can draw an array of potential performance indicators for programme activities, outputs, and outcomes to serve as indicator metrics, helping management to keep the programme on track to deliver intended impacts. Some of the indicators also will be useful for the impact analysis.

Not all of the indicators identified here need be developed. Taking into account the feasibility of data collection, existing data collection already in place, and stakeholder areas of interest, the programme administrators can establish priorities. It is, however, recommended that at least several metrics from each group be selected for tracking.

9.4.1 Activity-based Performance Indicators

These are short-term performance measures for activities that contribute to, but do not directly result in, an output. (Activities that directly result in output will be reflected in the output indicators in section 9.4.2.) This component of evaluation pertains in part to administrative efficiency, but also bears importantly on the ability to produce future outputs. (For example, outreach activities tend to be critical to the ability of a programme to solicit excellent proposals.) The programme may wish to develop an internally managed systematic data collection system and contract with an outside consultant to develop the desired set of indicator metrics. The following are suggested categories of activity-based performance indicators, with examples of data to be collected:

(1) Outreach indicators, such as the number of programme notices published, talks presented, brochures distributed, liaisons with partners, and frequency of webpage updates and/or visits. These measures can be stated in both absolute terms and as ratios to the GEN-AU budget to provide rough indicators of intensity of effort in implementing the programme.

(2) Proposal review and project selection administrative indicators, such as a timetable showing annually the timing of calls for proposals, the short- and long-proposal due dates, the review schedule, the contract negotiation schedule, and the timing of project starts. From the yearly timetable, a comparison of elapsed times for each activity can be developed. The results help to pinpoint problems for the research community in its interface with the programme, and provide a rough efficiency measure in programme implementation.

(3) Technology transfer activity indicators, such as number of publications screened and patenting opportunities identified, both in absolute terms and as a ratio to the GEN-AU budget, plus patenting opportunities identified as a ratio to the number of publications screened. These measures provide an indicator of the intensity of effort of the organization assigned to this task and may help signal variations in the patent-worthiness of funded research.

(4) Overall cost of programme administration, in absolute terms, as a percentage of the overall programme budget, and in comparison with that of similar programmes. These measures serve as a rough indicator of administrative efficiency.

(5) Additionally, there may be external questions focused on activities that must be addressed, such as questions about the fairness of the selection process or other quality issues. Such questions may require special data collection and rigorous analysis of results that exceeds the generation of activity intensity indicators, depending on who wants to know and what are the stakes.

9.4.2 Output-based Performance Indicators

These are trendable short-term performance metrics that indicate the direct results of the programme over time. It appears that GEN-AU is currently compiling some of these data. It is recommended that these indicators be generated annually and a trend line constructed across annual data. These indicators may include the following:

(1) Number of proposals submitted (absolute and average size, in terms of average amount of funding requested).

(2) Number of participating research entities by type represented in submitted proposals (absolute and as an average per proposal).

(3) Number of funded projects of each type supported by the programme -- cooperative projects, networks, pilot projects, associated projects, ELSA projects (absolute and average size in terms of funding).

(4) Number of participating research entities by type in funded projects (absolute and as an average per project).

(5) Number of participants in Mobility Programmes and cost of programme (absolute and as a ratio to total budget).

(6) Number of discourse days held and number of participants (absolute and as a ratio to total budget).

(7) Number of Summer School participants and cost of programme (absolute and as a ratio to total budget).

(8) Number of women scientists in identified roles (absolute and as a ratio to the number of men in these roles).

9.4.3 Outcome-based Performance Indicators

These are trendable indicators of medium-term outcomes that result from the programme's outputs. It is recommended that they be measured annually and the trend be shown year-to-year. These may include the following:

(1) Number of funded projects completed of each type (absolute and as a ratio to the cumulative number of funded projects of each type and overall).

(2) Number of funded projects terminated prior to planned completion, by reason of termination (absolute and as a ratio to the cumulative number of funded projects).

(3) Number of funded projects achieving technical success against milestones identified for each funded project (absolute and as a ratio to the cumulative number of funded projects).

(4) Number of funded projects yielding publications (absolute and as a ratio to the cumulative number of funded projects).

(5) Number of publications; also authors, titles, and affiliations for use in future co-publication and citation studies (absolute and as a ratio to the cumulative budget; these may be weight-adjusted to reflect varying importance of different publication media).

(6) Number of funded projects yielding patents (absolute and as a ratio to the cumulative number of funded projects).

(7) Number of patents; also patent numbers and titles for use in future citation studies. (absolute and as a ratio to the cumulative budget);

(8) Number of funded projects attracting R&D investment from other sources (absolute and as a ratio to the cumulative number of funded projects).

(9) Total amount of R&D investments from other sources to support continuation of funded projects (absolute and as a ratio to the cumulative budget).

(10) Number of projects with at least one commercial application including licensing arrangements (absolute and as a ratio to the cumulative number of funded projects).

(11) Number of commercial applications including licensing arrangements (absolute and as a ratio to the cumulative budget).

(12) Company formation and growth indicators such as change in company size or capitalization (generally these are possible to develop and track only for small companies for which the GEN-AU related tech-transfer component is a significant part of the company's total business).

(13) Number of related awards for scientific and business excellence (absolute and as a ratio to the cumulative number of projects or the cumulative budget).

(14) Percentage of Austrian scientists in GEN-AU projects who are participating in a national network of genomic research – as compared with percentage outside GEN-AU projects who are participating. In addition, it would be useful to compare participation rates for both groups before and after GEN-AU (Note: a definition of national network would be needed for implementation).

(15) Percentage of Austrian scientists in GEN-AU projects who are participating in one or more collaborative international genomic research projects – as compared with the percentage of comparable scientists outside GEN-AU projects who are participating in international genomic research projects. In addition, it would be useful to compare participation rates for both groups before and after GEN-AU.

(16) Changes in the size of the genomic industry in Austria over time (Note: a measure might be developed in collaboration with an industry association).

Patent indicators are listed above as a signal for progress towards realizing outcomes. But it is useful to note that patents counts and citations can serve as in multiple ways as objective criteria in the assessment of applied research and development programmes. Moreover, the data exist in the public domain and using the data is relatively unobtrusive.

An analysis of patents in a technology area may be helpful in ex-ante evaluations in determining if it is suitable for a public funding initiative. Patent analysis can reveal the long term development pattern of a technology area, and, subsequently, it can be deduced whether public funding is useful in the current stage of development. Upcoming sub-areas in a thematic field can be identified using patent analysis. Furthermore, the specialisation pattern of a country and the relevant players can be identified. The number of patent applications, the thematic specialisation and the number of co-operations with other countries show the positioning in the international context.

When using patent-indicators in ex-post and interim-evaluations, it must be taken into consideration that there is a significant time-lag between programme activities and patent output. Thus patent indicators generally are only useful in evaluations of applied research programmes after a time span of at least five years. However, the investigation of planned patenting activities can be carried out at an earlier point in time and can be useful for shedding light on expected patent activities and on the focus areas of programme participants.

9.5 Evaluating Longer-Term Programme Impacts

Impacts are defined as the longer term, larger consequences of the programme. For example, a project may yield a paper, which produces a patent, which results in a new treatment that ultimately improves health and extends life expectancy of the citizenry.

9.5.1 Requirements for Establishing Causality

The point was made earlier that impact questions are about causality, i.e., did the programme cause something to happen that otherwise would not have happened. To establish causality, we need to meet the following conditions:

(1) We need a logical theory showing that the hypothesized connection between the programme and the downstream consequences makes sense. This is accomplished by the logic model.

(2) We need to be able to show a downstream development of the type expected that fits the expected time order. This is accomplished by tracking and documenting the flow of events from inputs, to activities, to outputs, to outcomes, through to impacts, and showing a downstream impact whose linkage back to programme activities is documented.

(3) We need to be able to show that as the programme's inputs changed, the observed effects changed in the predicted direction, i.e., if a programme makes a difference, something should be different than it otherwise would have been. (This means that if we compared the annual number of collaborations of researchers who participated in the programme before and after they participated, we would expect to see a relative increase in collaborative relationships following participation, other things being equal.)

(4) We need to eliminate rival explanations that might also account for observed change. For example, if all researchers including those who did not participate in GEN-AU experienced similar increases in their rates of collaboration during the same period, there might be an alternative explanation to GEN-AU for the cause of the increase.

To be sure, most R&D programme evaluations in the world today do not consistently attain the level of rigor set forth above. Often meeting the first two requirements above - which can be thought of as a bare minimum - is considered sufficient. However, meeting the latter two requirements is required for best practice in evaluation. Rigor in evaluation is particularly important when a programme is being challenged to prove its effects.

9.5.2 Study Design

Study design is critical to a rigorous evaluation effort. Before- and after-programme comparisons and use of control groups are aspects of study design that are often used to meet requirements (3) and (4) listed above.

Including as a study design element a before-programme and after-programme comparison helps to develop support that the programme is associated with change. The before-programme look provides a baseline from which to measure change. At a minimum, the before look will provide a qualitative assessment of the relevant state-of-the-world before the programme was established. Better, the baseline will include quantitative measures characterizing the state of genomic research, researcher networks, and commercial activity in the field just prior to establishment of the programme. Because the programme is already underway, it may not be possible fully to capture the before-programme baseline. Capturing it as soon as possible, before programme results are realized, is recommended for purposes of impact assessment, if this has not already been done.

To help demonstrate that there are direct linkages from the programme's outputs to the coming on line downstream of new techniques for research, for industry, and for human health and quality of life, the evaluation method of publication and patent citation analysis is recommended. To help demonstrate the development of collaborative relationships network analysis based on co-publications and interviews are recommended.

To establish that it was the programme and not some other development that caused the observed before- and after- changes to occur, we look to the use of control groups and econometric analysis. If it were possible, we might use an experimental design with random assignment of researchers to the programme or not to the programme and perform a comparison of the results for the two groups. However, it is generally infeasible to apply a truly experimental study design for evaluation of R&D programmes. Instead, quasi-experimental and non-experimental design approaches are usually applied to help assign causality.

A quasi-experimental approach will include a before- and after-programme assessment and the use of a control group, but the control group will not be randomly selected and therefore can not be assumed necessarily to be equivalent to the group participating in the programme. If there is a sufficiently large group of genomic researchers in Austria who have remained outside the programme, they may comprise an effective control group for a quasi-experimental study design. But, of course, the results will have weakness unless it is possible to eliminate other reasons for differences in accomplishments of the two groups - other than programme participation.

A non-experimental approach is often used in R&D impact assessment to attempt to compensate for the lack of a control group. The approach is to provide "counterfactual comparisons." This means that survey or interview is used to solicit expert opinion about would have likely happened without the programme. In effect, the approach creates a pseudo control group – that is, the same group that exists with the programme is conceptualized as existing without the programme. To establish a counterfactual comparison, researchers funded by the programme are asked to compare what they have accomplished with the programme in place with what they think they would have accomplished had it not existed. In prospective analysis of R&D programmes, comparing the outcomes of alternative paths informed by counterfactual comparisons is usually unavoidable. Although this approach has obvious weaknesses in retrospective studies, it is considered superior to ignoring the issue altogether.

9.5.3 Outcome/Impact Measures and Methods

As we noted previously, converting the programme's mission and goals to questions identifies what measures are needed to assess the programme's performance – to determine if it has accomplished what was intended. Because the goals relate to a mix of outcomes and impacts, this treatment bridges across these categories and in some cases draws on trendable indicators recommended in section 9.4.

In selecting methods for measurement, it should be kept in mind by programme administrators that the more important, controversial, or subject to scrutiny a given measure is considered, generally the more rigor is justified in the evaluation. At the same time, it should be kept in mind that increasing rigor usually means increasing cost of the evaluation. Here, opportunities for increasing the level of rigor in evaluation are noted, but, because it is difficult for us to make the determination at this time as to what level is justified, the decision is left open.

Table 25 lists the questions that appear essential to the evaluation of GEN-AU assuming that the programme will be required to assess its success in achieving its mission and each of the pre-established goals. For each question, the table lists approaches that may be used to address the question:

Table 25 Outcome/Impact Evaluation Plan

Questions to Address in Future Impact Assessment	Suggested Approaches
Has GEN-AU created knowledge to enhance health and protect the environment?	(1) Publication and patent citation analysis linking GEN-AU research to downstream health and environmental developments; (2) Selected case studies to estimate health and environmental benefits resulting from programme-generated knowledge.
Has GEN-AU created new jobs?	(1) Survey of participating organizations, particularly small firms involved in tech-transfer, to determine job effects.
Has GEN-AU promoted women in leading positions?	(1) Internal data collection on women's roles in funded projects (see indicator metrics); (Note: If this question is particularly important, comparison data on women outside the programme may be compiled and analyzed.)
Has GEN-AU built up human resources, and promoted young researchers?	(1) Application of "capacity-based evaluation" to assess change in the scientific and technical human capital of participants in the programme; (2) Internal data collection on the numbers and career advancement of young researchers in funded projects; (Note: If this question is particularly important, comparison data on young researchers outside the programme may be compiled and analyzed.)
Has GEN-AU promoted technology transfer and industry -- as indicated by the creation of patents and start-ups, the strengthening of existing companies, and promoting the location of industry in Austria?	(1) Internal data collection on patents, company formation and growth, and commercial applications of research results (see indicator metrics) (2) Addition of before- and after- programme comparisons and use of control groups. (3) Profile of the changing face of the genome industry in Austria over time.
Has GEN-AU increased public acceptance of life sciences?	(1) Survey of general public who attended and did not attend GEN-AU discourse days.
Has GEN-AU increased a network of genome research in Austria?	(1) Network analysis (requires a before-programme comparison or, in absence of this, a benchmark conducted as soon as possible for comparison with an end-of-programme network developed through interview and co-publication analysis.); (2) Alternatively, a survey may be used to investigate extent of networking before the programme and after, but this will be a weaker approach.
Has GEN-AU strengthened genome research in Austria?	(1) Review by impartial review board of international experts, informed by the body of other evaluation results to address this broad mission-based question; (2) Alternatively a proxy such as before- and after- representation of Austrian scientists in international projects, or before- and after- international recognition of Austrian scientists in the field in terms of awards bestowed.

9.6 Data Collection

To implement a future evaluation of impact, the programme needs to prepare now by putting into place an overall data collection plan that addresses what data to collect, when, and by whom. This section provides the basis of such a plan, but there are decisions that the programme administrators must make before details can be added.

Activities data collection largely serves the purpose of internal programme management. It is recommended that activities data are compiled on an on-going routine basis, as activities transpire, by programme staff, and made part of the programme's database. If an issue arises externally regarding some aspect of quality of the activities, such as the afore-mentioned fairness of the selection process, it is recommended that a special study is commissioned using external evaluation experts to collect the data and carry out the study.

Output data collection also is best collected by programme staff routinely and systematically, and will naturally comprise the heart of the programme's database. Generally collection of these data is linked to the awards cycle. When proposals are processed is a natural time for collecting proposal data. When awards are made is a natural time for collecting project awards data. For projects underway, data collection may be conveniently linked to an annual review or reporting schedule. When projects are completed, final reviews and related reporting may similarly provide a good opportunity for data collection.

Outcome data collection is also largely best done annually by project staff in cooperation with managers of funded projects, using routine reporting requirements and tools such as a web-based data collection instrument. Data required to produce outcome indicators 1 through 13 in section 9.4.3 would lend to this mode of collection, as well as part of the data to produce output indicators numbered 14 through 16. But because these latter indicators have a component that lies outside GEN-AU, additional data collection approaches would be needed – most likely using an outside contractor to conduct a survey and search existing association or government industry databases. Collection of these additional data could be performed on a basis less frequent than annually.

Data collection for impact analysis requires multiple strategies and is more likely to be done by outside contractors. As indicated in Table 9-1, part of the data needed for impact analysis can be drawn from the programme's own databases, provided the programme implements a data collection plan in support of developing indicator data. Some of the trendable indicator data may be used to support impact analysis. To compile data needed for benefit-cost case studies, external consultants would interview funded researchers and companies within the projects, as well as companies who license the technology, and possibly others who cite the resulting patents. The results would be helpful in estimating value-added effects. These studies are best done retrospectively, towards the end of the programme. To compile industry growth estimates and to quantify change in the industry sector, external consultants will need to work closely with associations, access existing sources of government industry data, interview funded companies and companies citing and licensing research results on a periodic basis, and possibly conduct surveys.

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http://www.gen-au.at/projekt.jsp?id=37, Feb 7, 2005
http://www.gen-au.at/projekt.jsp?id=12, Mar 1, 2005

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http://www.nanoinitiative.at, Jan 11, 2005

Austrian Research Programme "FIT-IT" – webpage:
http://www.fit-it.at/

Austrian Research Promotion Agency – webpage:
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Deutsches Ressourcenzentrum für Genomforschung (RZPD) – webpage:
http://www.rzpd.de

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http://www.dialog-gentechnik.at, Oct 22, 2005

ERA-Net "PathoGenoMics" – webpage:
http://www.pathogenomics-era.net/

ESRC Genomics Network – webpage:
http://www.esrc.ac.uk/esrccontent/researchfunding/geninit.asp, Jan 12, 2005

Europäische Kommission: Empfehlungen zu den ethischen, rechtlichen und sozialen Fragen von Gentests:
http://europa.eu.int/comm/research/conferences/2004/genetic/pdf/recommendations_de.pdf

Federal Ministry for Education, Science and Culture (about GEN-AU) – webpage:
http://www.bmbwk.gv.at/forschung/fps/gen_au/uebersicht.xml, Oct 22, 2004

Genome Canada, Genome Education Center – webpage:
http://www.genomeeducation.ca/GEindex2.asp

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http://www.genomecanada.ca/GCethique/aPropos/index.asp?l=e, Jan 11, 2005
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German Human Genome Project – webpage:
http://www.dhgp.de, Oct 22, 2004

Institut für Tourismus und Freizeitwirtschaft, Wirtschaftuniversität Wien – webpage:
http://tourism.wu-wien.ac.at/cgi-bin/ift.pl?/services/coollinks/etourism.htm, Jan 11, 2005

Inter-University Research Centre for Technology, Work and Culture – webpage:
http://www.ifz.tugraz.at/index_en.php/article/articleview/5/1/2, Feb 8, 2005

National Genome Research Network (Germany) – webpage:
http://www.ngfn.de, Oct 22, 2004

National Human Genome Research Institute of the NIH – webpage:
http://www.genome.gov

Nature: "Japan announces follow-up to human genome project". online article:
http://www.nature.com/news/2004/040531/pf/429332b_pf.html

Office of Science – U.S. Department of Energy – webpage:
www.science.doe.gov

Research Institute of Molecular Pathology – webpage:
http://www.imp.univie.ac.at/genau/genau_descr.html, Mar 2, 2005

Science Communications – webpage:
http://www.science.co.at, Oct 22, 2004

Small Business Innovation Research Program, U.S. Small Business Administration, Office of Technology – webpage:
www.sba.gov/sbir

The U.S. Department of Energy's Biological and Environmental Research Program – webpage:
www.sc.doe.gov/ober/microbial.html

The U.S. Department of Energy's Genomics:GTL Program – webpage:
http://doegenomestolife.org

The U.S. Department of Energy's Joint Genome Institute – webpage:
www.jgi.doe.gov.

U.S. Department of Health and Human Services, National Institutes of Health: Grants and Funding Opportunities – webpage:
http://grants.nih.gov

U.S. National Science Foundation – webpage:
www.nsf.gov

Unizeit – das Forschungsmagazin, Karl Franzens Universität Graz. online article:
http://www.uni-graz.at/communication/unizeit/archiv/vor1999/195/1-95-08.html, Jan 11, 2005

Vienna Interdisciplinary Research Unit for the Study of Science and Society (VIRUSSS), Department for Social Studies of Science, University of Vienna – webpage:
http://www.univie.ac.at/virusss, Feb 7, 2005

World Health Organisation: Genetic Databases – Assessing the Benefits and the Impact on Human and Patient Rights:
http://www.law.ed.ac.uk/ahrb/publications/online/whofinalreport.doc

10.4 List of Interviews

Programme Management and bm:bwk

1. Bürgermeister, Maria; Fiala, Katja; Fuchs, Alexandra (GEN-AU office)
2. Pasterk, Markus (bm:bwk)
3. Tischelmayer, Elisabeth (bm:bwk)

SAB Members & former SAB Members

4. Lehrach, Hans (MPI for Molecular Genetics)*[124]
5. Palese, Peter (Mount Sinai School of Medicine)
6. Schatz, Gottfried (Swiss Science and Technology Council)*

Programme Participants

7. Adam, Gerhard (BOKU)
8. Berger, Wilhelm (University of Klagenfurt)
9. Czerny, Thomas (University of Veterinary Medicine Vienna)
10. Felt, Ulrike; Fochler, Maximilian; Müller, Annina (University of Vienna)
11. Gottweis, Herbert (University of Vienna)
12. Grasl-Kraupp Bettina (Medical University Vienna)
13. Günzburg, Walter (University of Veterinary Medicine Vienna)
14. Hofmarcher, Maria (IHS)
15. Höglinger, Othmar (UAR)
16. Horn, Matthias (University of Vienna)*
17. Hubensdorf, Michael (Medical University Vienna)
18. Huber, Lukas (Innsbruck Medical University)
19. Jenuwein, Thomas; Kahr, Larissa (IMP)
20. Kovar, Heinrich (CCRI)
21. Kraut, Norbert; Maurer-Fogy, Ingrid (Boehriner Ingelheim Austria)
22. Lackinger, Franz (Sun Microystems GmbH)
23. Lafferty, Julia (Saatzucht Donau GmbH & CoKG)*
24. Mittermayr, Christian (Lambda GmbH)*
25. Penninger, Josef (IMBA)*
26. Redl, Heinz (LBI for Experimental and Clinical Traumatology)*
27. Schöftner, Rainer; Mühlhofer, Dietmar; Gusenbauer, Markus; Brandecker, Dieter (Profactor GmbH)
28. Schuster, Peter; Hofacker, Ivo; Flamm, Christoph (University of Vienna)
29. Schütz, Gerhard (University of Linz)
30. Stockinger, Hannes (Medical University of Vienna)
31. Thallinger, Gerhard (Graz University of Technology)
32. Torgersen, Helge (Austrian Academy of Science)
33. Trognitz, Bodo (ARCS)
34. Zatloukal, Kurt (Karl-Franzens University Graz)
35. Zechner, Rudolf; Schober, Caroline (Karl-Franzens University Graz)

[124] * telephone interview

Programme Partners

36. Buchtela, Georg; Kemper Oliver (aws/tecma)
37. Glößl, Josef (ÖGGGT)
38. Martos, Alexander (science communication)
39. Maurer, Johannes (RZPD)
40. Streicher, Barbara; Schneider-Voss Susanne (dialog<>gentechnik)

International Experts - Scientists

41. Altman, Sidney (Yale University, US)
42. Gesteland, Raymond (University of Utah, US)
43. Gilna, Paul (Los Alamos National Laboratory, US)
44. Snyder, Mike (Yale University, US)
45. Stubbs, Lisa (Lawrence Livermore National Laboratory, US)

International Experts - ELSA

46. Burgess, Michael (University of British Columbia, CA)*
47. Haddow, Gilian (Innogen, University of Edinburgh, UK)*
48. Levitt, Mairi (CESAGen, University of Lancaster, UK)*

International Experts – Programme Management

49. Laplace, Frank (BMBF)*
50. Schilling, Linda Beth; Walsh, Michael; Klein, Andrew (ATP, US)

Non Participants

51. Binder, Bernd (Medical University of Vienna)
52. Decker, Thomas (University of Vienna)
53. Heberle-Bors, Erwin (University of Vienna)
54. Schroeder, Renée (University of Vienna)
55. Wacheck, Volker (Medical University of Vienna)

Stakeholders

56. Herlitschka, Sabine (former member of BIT, now Medical University Graz)*
57. Huber, Jan Oliver (Pharmig)
58. Jud, Thomas (AVCO)
59. Kacani, Ladislav (CAST)
60. Mesner, Simone (RFT)
61. Müller-Niklas, Gerald (Brainpower Austria)
62. Murauer, Gerald (WWTF)
63. Schaude, Michael (Association Campus Vienna Biocenter)
64. Schmid, Arnold (former president of FWF)
65. Sturn, Dorothea (former TIG, now part of FFG)
66. Tebb, Graham (FWF)
67. Wick, Georg (president, FWF)
68. Zacherl, Nikolaus (ABI)

Young Scientists

69. Mamnun, Yasmine (Cancer Research, UK)
70. Martens, Joost (IMP)
71. Pedrosa-Harand, Andrea (University of Vienna)
72. Timischl, Birgit (Graz University of Technology)

Please note that some of the interview partners fit into multiple categories and have multiple affiliations. These people are only listed once. The listing depends on the questions asked in the appropriate interview.

11 Appendix

11.1 Set-Up and Response Rates for the Online Survey/SNA Analysis

The survey used for the SNA is based on a standardised online questionnaire and was carried out over a period of 6 weeks (February 1, 2005 until March 10, 2005). The questionnaire was sent to all project coordinators and project leaders involved in GEN-AU projects as well as to the representatives of the GEN-AU office, the Federal Ministry for Education, Science and Culture, the partner institutions and the Scientific Advisory Board. In total, 99 individuals were addressed with the questionnaire. All project leaders were asked to forward the questionnaire to two project collaborators for further enhancing the data base. Table 26 shows the return rates broken down by different players and player groups. In total, 51 questionnaires were returned which is corresponds to a 52 % response rate. However, as the SNA needs high response rates in all player categories to yield significant results, different return rates in different player groups have to be taken into account when interpreting the results.

Table 26 Response Rates by Player Groups for the Online Survey

Players Group		Addressed Players	Return**	
		N	N	%
Cooperative Projects	project coordinators	4	3	75.0
	project managers	2	2	100.0
	subproject leaders	20	12	60.0
	project collaborators		5	
Network Projects	project coordinators	2	2	100.0
	project managers	1	1	100.0
	subproject leaders	7	6	85.7
	project collaborators		1	
Pilot Projects	project coordinators	7	3	42.9
	project managers	2	0	0.0
	subproject leaders	15	4	26.7
	project collaborators		2	
ELSA Projects	project coordinators	6	2	33.3
	subproject leaders	4	2	50.0
	project collaborators		5	
Associated Projects	project coordinators	5	3	60.0
	project collaborators		1	
Programme Office		3	3	100.0
Programme Partner Institutions		8	6	75.0
bm:bwk		2	2	100.0
SAB*		11	0	0.0
TOTAL		99	51	51.5

Source: Austrian Institute for SME Research

Remark: 14 project collaborators not included

11.2 Code List for the SNA Network Graphs

VP	Cooperative Projects
VPS	Cooperative Subprojects
NP	Network Projects
NPS	Network Subprojects
PP	Pilot Projects
PPS	Pilot Subprojects
EP	ELSA Projects
EPS	ELSA Subprojects
AP	Associated Projects
PB	Programme Office
PA	Programme Partner-Institutions
BM	Federal Ministry for Education, Science and Culture (bm:bwk)
WB	Scientific Advisory Board
IP	Industry Partners
FA	Foreign Genome Researchers
FÖ	Austrian Genome Researchers

11.3 Glossary

ABI	Austrian Biotech Industry (Working group of Austrian Biotech companies)
ARCS	Austrian Research Centers Seibersdorf
ASA	Austrian Space Agency
ATP	Advanced Technology Program (USA)
AVCO	Austrian Private Equity and Venture Capital Organization
aws	Austria Wirtschaftsservice GmbH (Bürges, FGG, Innovationsagentur; organizational integration of ERP Fond)
BIT	Bureau for International Research and Technology Cooperation (now part 4 of FFG)
BMBF	Federal Ministry of Education and Research (Germany)
bm:bwk	Federal Ministry for Education, Science and Culture
BOKU	University of Natural Resources and Applied Life Sciences, Vienna
CAST	Center for Academic Spin-offs Tyrol
CCRI	Children's Cancer Research Institute
ETHZ	Swiss Federal Institute of Technology Zurich
FFG	Austrian Research Promotion Agency (comprising BIT, FFF, TIG, ASA)
FFF	Austrian Industrial Research Promotion Fund (now section 1 of FFG)
FWF	Austrian Science Fund
IMBA	Institute for Molecular Biotechnology
IMP	Institute for Molecular Pathology
JR	Joanneum Research
KMFA	Austrian Institute for SME Research
LISA	Life Science Austria – focused programme of the aws
LBI	Ludwig Boltzmann Institute
MPI	Max Planck Institute
ÖAW	Austrian Academy of Science
ÖGGGT	Austrian Association for Genetics and Genetic Engineering
Pharmig	Association of Pharmaceutical Companies
RFT	Austrian Council for Research and Technology Development
RZPD	Deutsches Ressourcenzentrum für Genomforschung GmbH
Tecma	aws department dealing with protecting and marketing IPR
TIG	Technologie Impulse Gesellschaft (now section 2 of FFG)
UAR	Upper Austrian Research GmbH
WWTF	Vienna Science and Technology Fund