The great art of project management: managing the 8 Dimensions

Helwig Schmied, Kenneth Brown

Abstract

Project planning and execution takes place in eight dimensions. Each of them plays an important role in keeping deadlines, budgets and quality of results. These eight dimensions are the people in the project, the communication and collaboration between them, the results or deliverables produced by them, the transfer of results within the project (including information transfer between departments or organizations), the time dimension, various types of knowledge, the handling of risk, and finally the coordination of several sub-projects or projects.

The integration of these eight dimensions in a coherent planning methodology and their handling and display in a single planning tool enables a considerable improvement of project performance and overall company productivity. The following article explains this in detail.

Introduction

In the 1990's, a rather unique gathering occurred. Faced with the fierce competition of Japan, European carmakers were increasingly losing market share. Even powerhouses such as Daimler-Benz were consistently losing money, while the Japanese were steadily gaining market share. Many directors were already figuring out how many times over Toyota had the financial strength to swallow their company if they wanted to. It is in this context that the main players of European automotive industry got together to figure out a way to rise up to the challenge.

The culprit lied in the fact that Japanese car producers introduced new models much faster to the marketplace than the Europeans did. For instance, new types of vehicles such as small convertibles and 4x4's were brought to market, and it would take years before the European carmakers would be able to present anything similar. A research carried out to understand the reasons for this competitive disadvantage yielded that the Japanese were successful in implementing "Simultaneous Engineering" on a large scale, i.e. they found a way to develop a vehicle while simultaneously developing the production line that would later produce the model. For many reasons, this was very difficult to do at the time, in particular because in Europe, production technology had been spun off to independent entities (even companies such as "Renault Automation" or "Peugeot-Citroen Industry (PCI)" were no longer part of the respective car makers). Japan on the other hand had a structural advantage: production technology companies were very close to the car manufacturers thanks to their *shiretsu* networks. But this only explained part of the phenomenon. The Japanese had obviously figured out a way to interweave the two highly complex development processes of car development and production system development. At that time, it took just as long to develop a vehicle as it did to develop and install the production system: 2-3 years. The result of this was that it took the Japanese 3-4 years to get from an initial product idea to market introduction, contrasted to 6-7 years of time-to-market in Europe.

In the industry, the two processes were naturally carried out sequentially—how could you possibly develop a production system if you didn't have the product's blueprint? Carrying out the two development processes in parallel obviously meant a whole different way of organizing the two, and of course also meant that the two needed to be closely coordinated. It turned out that as demonstrated with Kaizen/CIP, JIT and many other approaches, the Japanese were once again better because of superiority in management—not technology.

From 1993 to 1995, the major European car manufacturers that in daily life were in harsh competition initiated a project to find a way to accelerate time-to-market by improving the

management of the product and the production system development. What is more, they invited their suppliers for production systems to the table—quite a feat in regard of the usual "pecking order" between car manufacturers and their suppliers. In all, the companies sent 32 project planning specialists to work in Project SICPARI (Simultaneous Engineering for Car Producing and Related Industries).[1] the results of which were published.[2]

Project SICPARI opened completely new perspectives inasmuch as it opened a completely new way of planning projects that has little in common with known Gantt or network diagram approaches. It was also successfully implemented by FIAT in 1997: the first car developed following the SICPARI approach, the Lancia Y, was brought to market in a mere 25 months.[3]

Yet just as any truly path-breaking approach, it brought up many additional questions, e.g.: How do we organize the work of individuals? What does it mean exactly to transfer information from one department to another? What do we do when the two departments disagree after delivery? What do we do when the project plan changes? How do we handle risk? How do we detect problems in the coordination early in time? How do we integrate existing knowledge, and how do we store new knowledge for exploitation in future projects?

Answers to these and many other questions needed to be found in order to translate the SICPARI concept into something that could be immediately implemented by any company. Since 1995, the ERMITE Institute of Strasbourg University has been developing a concrete management methodology called Business Communication Engineering (BCE) based on the results of Project SICPARI.[4] Approx. 30 industrial companies in Germany, France, Spain and Belgium were involved in this development. These companies accepted to be the "testing labs" for new components of the BCE methodology. The working method was to analyze the companies on site, identify problems in their project management practice, and to elaborate solutions based on the notions developed in SICPARI or previously developed modules of BCE. These solutions were tested in real life. Successful solutions became part of BCE, while unsuccessful solutions were discarded. BCE is thus based exclusively on industrial experience.

This paper explains the SICPARI planning approach, the conceptual basis of the BCE methodology and provides an outlook on future development that includes planning complex projects in a three-dimensional view.

The 3 dimensions of the SICPARI communication plane

The first result of the SICPARI specialists' reflections was that the planning of a project that involves independent industrial companies in the same project to carry out complex tasks in parallel could not be done with traditional methods. This type of approach was termed "External Simultaneous Engineering", in contrast to usual Simultaneous Engineering of, e.g., the development of a piston in parallel with its engine block using advanced product development software. To manage External Simultaneous Engineering (ESE), a new means of organizing the work had to be found. The most promising approach was based on planning the communication flow between the project members in (and between) both companies. This seemed to be the only way to get to grips with the rich inter-company information flow necessary to coordinate the two complex processes. In order to translate these thoughts into a planning methodology, two pilot projects were selected: a car body and a gearbox. The development of these components and their respective production systems was to be carried out in parallel.

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[1] The companies participating in Project SICPARI were: Comau S.p.A., IWKA AG, KUKA Schweißanlagen + Roboter GmbH, Mercedes-Benz AG, Peugeot Citroën Industrie, PSA, Renault S. A., Renault Automation S. A., Siemens AG, **Telemechanique**, Volkswagen AG.

[2] Gerhardt A., Schmied H., Externes simultanes Engineering, Springer, Berlin-Heidelberg, 1996.

[3] Testore, Director General FIAT Auto, private communication, June 1998

[4] A spin-off called Communigram SA founded 2005 develops software packages on an industrial scale that provide tools to implement BCE quickly with a steep learning curve.

In order to plan the communication between the car manufacturer and the supplier for the production system, a "communication plane" was built up between them. Fig. 1 shows the graphical result. The left side of the communication plane represents the work necessary to develop a new car body, while the right hand side shows the development of its production system. Both halves show the departments (system functions) involved as columns, and the tasks as lines. Into this two-dimensional communication plane, communication between the departments, both within the companies as well as between them, is added as a 3rd dimension. Each needed communication flow is modeled by drawing an arrow. An arrow means that the result of the task needs to be sent by the department that produced it, i.e. its "supplier", to the department (or departments) that needs this information as an input to carry out the next step. These receiving departments are called "clients". Black arrows show the transfer of results within the same company, while red arrows mean that information needs to be transferred between the two companies. Blue arrows illustrate that cross-company coordination is needed. The green arrows are actually loops going back: their meaning is that certain steps of the project need to be repeated when an intermediate result is considered insufficient in a milestone/gate[5].
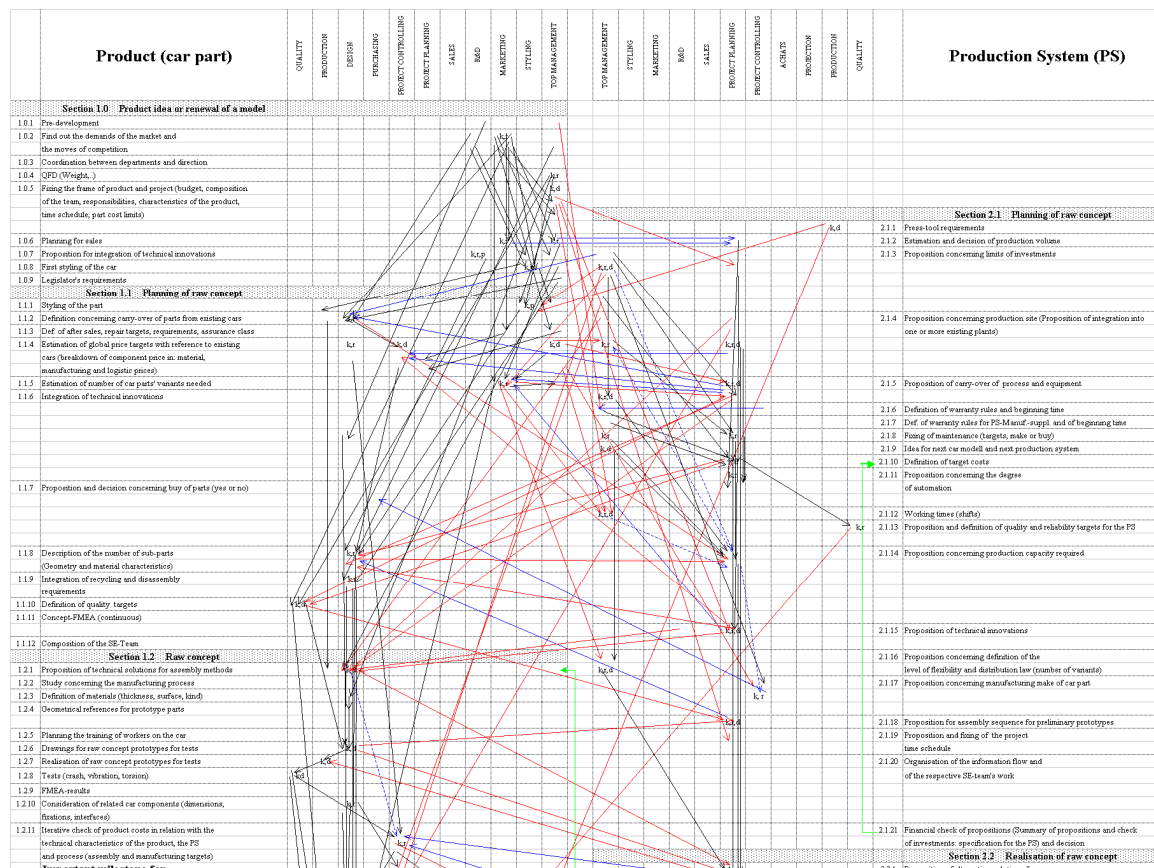

Figure 1: Partial view of the Communication Plane as developed in Project SICPARI

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[5] For example, if the target cost is exceeded.

From the SICPARI-communication plane to the 5 dimensions of Business Communication Engineering

The first attempt made in Project SICPARI to organize external simultaneous engineering (ESE) was to use the classic Gantt view to plan various parts of the project in parallel. Very soon however, the project planning specialists came to the conclusion that it is very difficult to organize the needed communication flows using a Gantt chart. Although maybe principally possible, it was concluded that a better way needed to be found to plan communication flows between people and departments. The type of plan they required to handle the complexity of ESE had to take into account the following aspects, which are called the "5 W's of Communication" in the BCE methodology: What, Who, with Who (Collaboration), for Whom, and at the very end: When. These 5 W's constitute the first five dimensions that need to be integrated in the project plan:

1. What (Tasks/Deliverables): the individual and overall results of the project work, i.e. the tasks and the task and/or project deliverables.

2. Who (Responsible): all project responsibles and contributors, regardless of where they are and which organization they belong to.

3. With Whom (Participants): the project participants who also contribute to each task with the objective of producing tangible and measurable results (deliverables).

4. For Whom (Communication): the transfer of information and finished deliverables from the responsibles to all those that need this as an input. This dimension also includes taking into account the need for speedy transmission and digestion of information.[6]

5. When (Time): the time dimension; the planning of the project execution over time.

The difficulty we all have in planning a project with today's possibilities is that we only dispose of two dimensions on paper or on a computer screen. From this perspective, the most primitive model of a project is reducing it to its two most basic aspects: What (tasks or deliverables) has to be done and When (the time axis). This is indeed what we have in a Gantt chart, a modeling technique developed almost a century ago in a time (Industrial Revolution, WW-I) when the challenges of management were, to say the least, quite different from today.
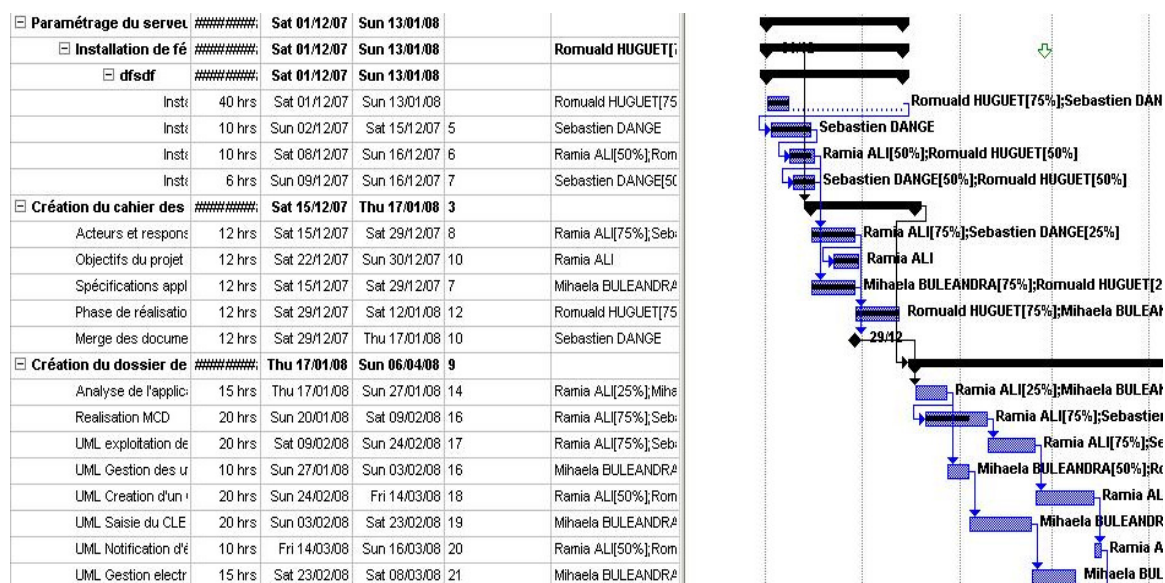

Figure 2: Gantt view showing after the time bars the names of the people expected to carry out the work

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[6] Project SICPARI clearly demonstrated, that even small systematic delays in the transmission of results from suppliers to their clients result in considerable project delays.

The Gantt view neglects who is really responsible in the project and reduces communication (if it is considered at all) to a "predecessor-successor-relationship". Of course, we frequently encounter the names of the people working on a task after the corresponding time bar. In our experience however, this is not at all sufficient. First of all, this does not allow communication to be organized between these people. Secondly, this is not an appropriate means of motivating people. People are often called the most important asset of a company. They definitely are the most important asset of a project. A mere textual reference to these "resources" as they are called in project management lingo makes it difficult for people to find their work, and it does not visually show how important their contribution is for the success of the project. Thirdly, this view does not solve a very fundamental problem of management: for the elaboration of a deliverable, responsibilities need to be defined absolutely unambiguously. This is trivial as long as there is only one person assigned to each task. Usually however, several people or even a complete team need to perform the work. In this case it is mandatory to define who is leading the team and is thus responsible for the elaboration of the deliverable.

The 8 dimensions as Visual Modeling View in the Communigram

The discussions with the industry showed that it was necessary to further develop the SICPARI communication plane and the BCE approach for achieving project management excellence and also a practical usage in business. This evolved to a so-called "Communigram" that could integrate all eight dimensions into a single project plan that is so simple to use, that any project participant can use it. As in SICPARI, the main elements of the Communigram are the tasks or deliverables of the project (**first dimension**), shown as rows, and the participating people and departments (**second dimension**), shown as columns. The first thing that is new in the Communigram with respect to the SICPARI communication plane is that both rows and columns are hierarchic. Colored rows show that a row represents a sub-project (orange rows), often called a WBS element in project management, or an entire project (blue row). Similarly, blue columns depict organizational units such as organizations, divisions, departments, sub-departments and teams.[7]

With this view, it now becomes possible to project the **third dimension**, the responsibilities between project members, into this two-dimensional plane. This is done using a combination of interconnected dots. Large dots mean that a person is responsible for the elaboration of the deliverable, i.e. the task "leader", while small dots mean that a person participates in the elaboration.[8] A horizontal "collaboration" line to indicate that these people need to communicate to coordinate their work in order to produce the deliverable within the time frame at their disposal connects these dots.

The **fourth dimension** now reflects the communication between project members. The large dots will be connected with unidirectional arrows to show where the resulting deliverable will go once available. These arrows however also mean that the people on the sending and receiving side, i.e. the future information supplier and client, need to communicate in the planning phase to define what exactly is needed. This avoids misunderstandings during the project execution. They also need to communicate any boundary conditions the other party needs to know about. A further use of these arrows is to transfer preliminary information to the clients so that they can start work earlier—a sort of simultaneous engineering at the task level—which is particularly interesting when the work is on the critical path or critical chain.

The **fifth dimension**, the time axis, is implicitly (and thus unsatisfactorily) included in the "Communigram" through the succession of arrows from top to bottom. In order to make the illustration of this dimension easy, a Gantt chart is used. It is directly attached to the "Communigram" and is therefore available in the common view.

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[7] If the Communigram is drawn using its software package, the rows and columns can be collapsed, thus allowing the planner to "zoom in" on certain parts of the project plan that are of interest, while hiding unnecessary detail.

[8] A third case also exists: small circles. These mean that a person is informed of the progress of the deliverable.
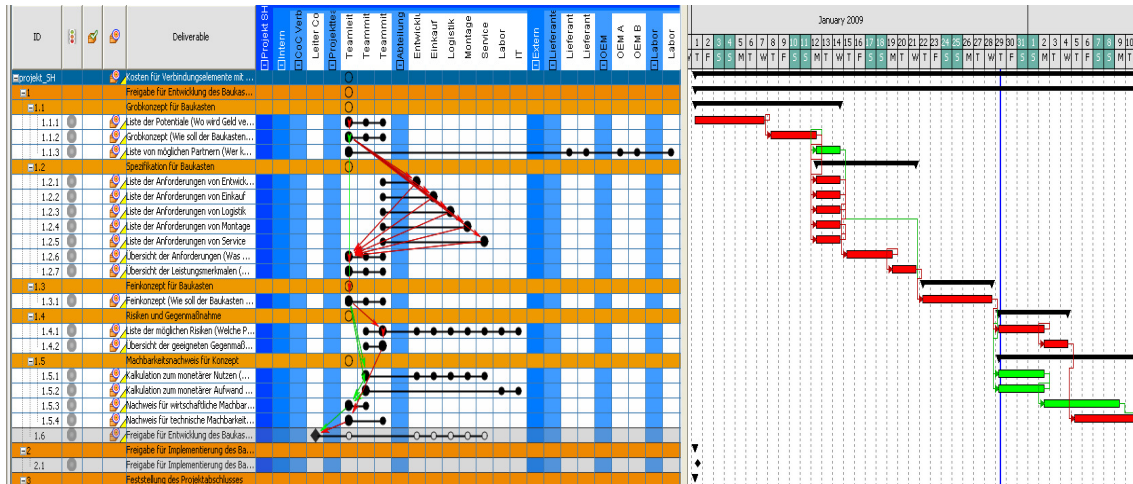
Figure 3: Communigram with departments (blue columns), project participants and responsibilities (white columns), sub-projects (orange rows), tasks/deliverables (white rows), responsibilities and collaboration (interconnected dots), transfer of results (red and green arrows), and integrated knowledge management (columns with target and package icon). The right hand side shows the same project as a Gantt chart.

The Sixth Dimension: Knowledge

The sixth dimension is knowledge. Knowledge has several aspects in BCE. One aspect of knowledge needed is the experience of each project participant concerning the necessary work to be done in order to reach the project's objectives (1). But it is also necessary to integrate all available documented knowledge into the project plan (2). This includes all documents necessary for the work on each individual deliverable, but also all documentation produced as a result of the task. Another aspect of knowledge is, to learn of each project for future projects and to store (3) this knowledge in a context that is useful for the future.

The aspects of knowledge are integrated through additional columns in the Communigram. They are identified by a target and a package (and input arrow icon), respectively. This is where all three aspects of knowledge needed for project planning and execution as well as the lessons learned are documented.

1. Process Knowledge to deliver the project content

In order to integrate the experience of people into the project plan, the BCE methodology prescribes an exclusively result-oriented, decentralized planning process. This means that all people responsible for the elaboration of a project result (deliverable) must actively participate in the planning of the project and define their 5 "W"s in detail.

In practice, this is achieved using the "supplier-client" planning method. This method includes a rule set that demands that each deliverable to be produced in the project is defined not by the person doing the work (the deliverable "supplier"), or the project manager for that matter, but the people who need the deliverable as an input in order to produce their own deliverables, i.e. the "clients" of the deliverable.

Clients and suppliers therefore need to attune. This is particularly useful, when supplier and client do not speak the same language. This does not necessarily mean the mother tongue, technical language and lingo can be just as misleading. For instance, an engineer does not always understand specific marketing or financial terminology, just as a salesman will often have difficulties understanding technical details (unless he was an engineer himself). But even technical people do not always understand each other: mechanics and electronics seem to have little common ground, just as biology and materials. Nonetheless, many new technologies are compounds (mechatronics, biomaterials, …), communication therefore becomes necessary. Even production technology is surprisingly often a closed book for many developers. Particularly in simultaneous engineering projects, the communication of people disposing of dissimilar cognitive systems (through education and comprehension) proves very difficult.

Training courses to fill this gap by teaching them how to speak the "foreign language" have been designed, but proved to be inefficient. [9] Experience has shown that it is quite useless to provide marketing courses to engineers so they may have less communication difficulties when in contact with Marketing. The approach suggested by the BCE methodology is far more pragmatic and has already proved its effectiveness.

The need for attuning between suppliers and clients to unambiguously define the deliverable must lead to a common understanding what exactly must be delivered, how it must be delivered, and in which form. The supplier must have a clear understanding, under which exact conditions the deliverable will be accepted and considered satisfactory, even if the result turns out to be "negative". For instance, a lab report may indicate that a prototype did not pass an important test. While this is of course in any case unfortunate and the client of the information will not be particularly enthused, it must be considered "satisfactory" if the testing work was conducted thoroughly. While "thoroughly" may imply to one that simply all test steps were done according to certain norms, to another it may mean that the testers should have gone on to inspect the sample in an attempt to understand the reason for failure. Similarly, a marketing person might consider it sufficient to supply the company with the latest trends and customer wishes along with a rough estimate of possible sales volume as the result of a "Market Analysis", while the engineering department might expect a target price and a detailed list of expected technical characteristics. In any case it is absolutely necessary to bridge any comprehension gaps beforehand so that a shared understanding about the targeted deliverable is available. This enables people to work much more efficiently and, perhaps even more important, avoids misunderstandings that would otherwise lead to rework and other disasters.

In the Communigram, this is enabled through a window in which the deliverable is described in detail, as shown in Fig. 4.

In the output window, the deliverable is described as detailed as possible. This output description represents the list of duties for the team elaborating the deliverable. This description is either filled out during a common planning meeting, or electronically via myCommunigram using a workflow algorithm until the supplier and client agree on the deliverable. The result of this attunement is an integral part of the project plan, since it is documented under the target icon and visible to all via the project plan.
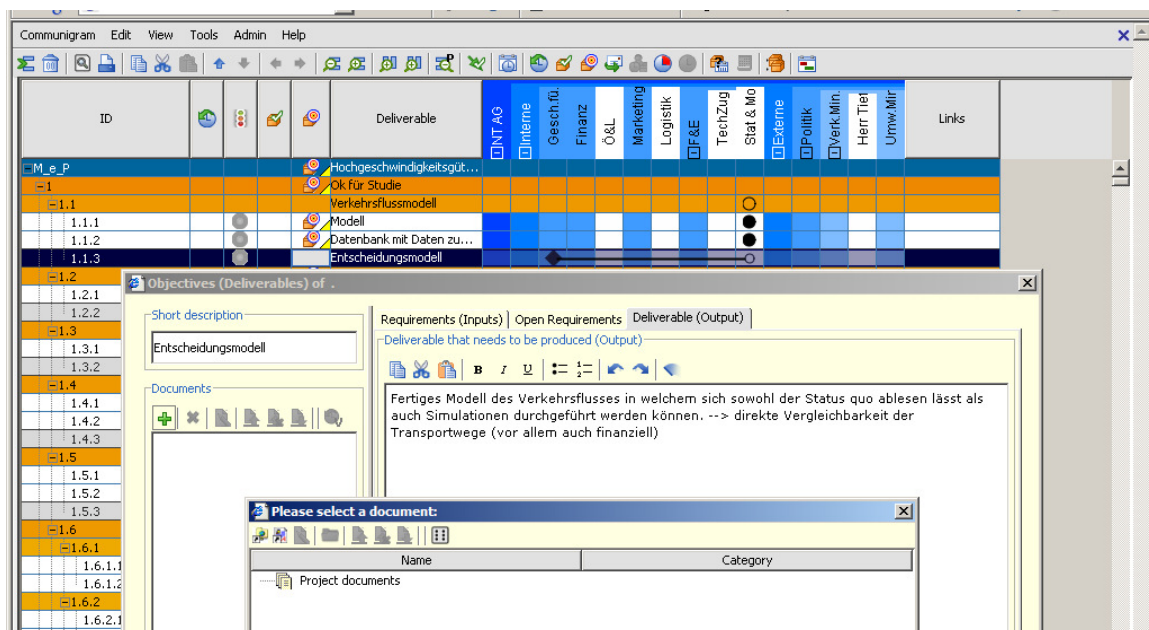
Figure 4: Target Window open, showing Input and Output Window and Document Management

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[9]   See for example doctoral thesis of Holger LINKE : Communication et qualification professionnelle dans l'industrie de la productique, le cas de l'ingénierie Simultanée dans l'industrie automobile européenne, Université Louis Pasteur, 1997.

The following example illustrates this process: one important deliverable is to conclude a necessary contract with an external supplier. The deliverable is therefore the signed contract. The details of the contract are listed in the output window, or they are written into a contract template that can be accessed directly from this window. The task to reach this contract signature is called "Contract Negotiation". The information necessary to prepare this negotiation is listed in the input window. The negotiation leader (large dot in the Communigram) is therefore e.g. client of the deliverable "Financial Situation of the Future Partner", which in turn needs to be supplied by the Finance department.

To support this particularly important aspect of coordination between suppliers and clients, the BCE methodology suggests the following rule set:

The work for a deliverable is finished when:

1. The Deliverable is available

2. The Deliverable is documented (in the "package" column)

3. The Deliverable is sent to all Clients

4. The Deliverable is accepted by all Clients

If one or several Clients refuse a deliverable, this usually means time-consuming rework, thus generally leading to a change in the project plan. It might even endanger the completion date of the project. If the reason for the refusal lies in insufficient previous attunement between the Supplier and the Clients, then both are reprimanded. This however needs to be made known to all project participants as a rule.

Project planning is an interactive process that usually involves several loops to make the project plan as complete and precise as possible at the time of the planning. In one of these loops, each leader of a deliverable needs to verify whether all information inputs necessary for the elaboration of the deliverable are indeed planned for. Each needed input has to be entered into the input window. This allows verifying whether the production of the input is already planned somewhere in the project. In this case, it is sufficient to connect the two leaders with an arrow. If the corresponding deliverable is still missing, at least one additional deliverable needs to be planned. Sometimes it even means several deliverables. Our experience has shown that this approach reveals up to 20% missing deliverables that can now be integrated into the project plan. The knowledge and the experience of the project members and their discussion avoid misunderstandings and delays in project execution. Indeed, any "forgotten" deliverable leads to an expensive, time-consuming fire brigade action once the project is under way.

2. Knowledge of documentation in the right context

As described above all communication details and also all documents necessary for the elaboration of the deliverable are added to the project plan and are accessible via the target icon of the corresponding deliverable. Since the same document may be needed in several deliverables, multiple linkages are possible. The main idea here is to get any knowledge available from local hard disks, file servers, or simply heads, and make it directly available exactly where the people are looking for it.[10]

The documentation produced as a result of each deliverable is stored in the project plan. The rule described above that stipulates that the work on a deliverable is only finished once it has been documented is particularly important here. This rule along with the other rule that a deliverable (and thus the deliverable's documentation) must be accepted by *all* Clients before it is considered finished ensures that results are systematically documented, and that this documentation has been checked properly. In addition, this rule solves another problem. For many reasons, it is difficult to get people to document their work, and even more so their experience. Since in this system the Client will not accept the result if it not properly

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[10] A study conducted at one of our partners, an automotive supplier, revealed that project members spend up to 30% of their time looking for information that in principle is readily available, but hard to find in file servers, e-mails, project workspaces, folder cabinets, etc.

documented, documentation becomes an integral part of the project execution work and is done without any major difficulties.

3. Knowledge of Lessons Learned

For the sake of experience capitalization, all finished projects are later stored in their entirety within the database. This makes it possible to use search engines and other technologies for knowledge retrieval to exploit the stored knowledge. The difficult part was getting the data *into* the database. Apart from this, it is now also possible to find the person or people that were working on a specific topic. This aspect is particularly useful. Experience has shown that people that are rather reluctant to read existing documented knowledge will happily meet with the people that did the work and discuss with them what might work for the new project.

Out of the finished projects it is now possible to build the project database, which consists of standardized project templates and modules. The standardized projects are shown as Communigrams. They contain the list of all deliverables that in sum have made the last similar project a success. Each deliverable disposes of a "target". In this target, the inputs and outputs are defined (see above), and all needed documents can also be uploaded to this same location. This makes the latest version of all documents immediately available to the new project team, without changing screens. When the organization begins a new project, the new project leader can quickly set up the basic structure of the new project simply by copying and pasting the needed project or modules. This structure will contain not only detailed descriptions for each necessary deliverable, but also the successfully used documentation and therefore the appropriate organizational knowledge.

The Seventh Dimension: Risk and Its Management in Communigram

Due to its uniqueness, each project bears the risk that its objective will not be attained in time, within the allocated budget, or at all. And in each case the risk exists that the quality of results could be considered less than expected. We distinguish three different aspects of risk, all of which are managed using the BCE methodology and Communigram tools.

1. Evaluation and planning of risks

2. Knowledge of actual risks during the project

3. Management of risk

1. Evaluation and Planning Risks

The risk of not completing the project in time is already considerably reduced thanks to the way the project is planned. Since every project participant contributes to the project planning effort according to the principle of decentralized planning, a project plan is generated that is as complete as humanly possible. This avoids time-consuming fire brigade actions from the outset.

In BCE, the evaluation of risk is also performed in a decentralized manner. Each deliverable leader can judge the risk involved in producing his deliverable (of course, in case of doubt, external experts can also be asked their opinion). Since we want to do this throughout the entire project, a very simple evaluation approach is used. Based on various industrial experiences, we distinguish four levels of risk:

Risk level 1: Routine

Risk level 3: Problem can be handled, "normal" difficulty and risk

Risk level 5: Solution in principle known or state of the art, yet new for the team, "medium"

Risk level 15: It is not sure whether the result can be elaborated at all, "high"

These risk numbers are added to the column "Risk" in the Communigram. The corresponding deliverables can be filtered out. This yields a list of "Risk 15 Deliverables" that are entirely

integrated in the project plan. The BCE methodology now recommends "front loading" of all deliverables of risk 15 by scheduling them to take place as soon as possible. This means that if the project is bound to fail due to risk 15 deliverable that cannot be resolved, the project will fail early, thus limiting costs and freeing up the precious manpower so they can be assigned to other projects.

A further means of handling risk is the rather unique possibility of planning alternative paths beforehand in Communigram. If a risk 15 deliverable leads into a dead end, an unlimited number of alternative solution paths (Plan B, …) can be defined. This is shown in Fig. 5 below.
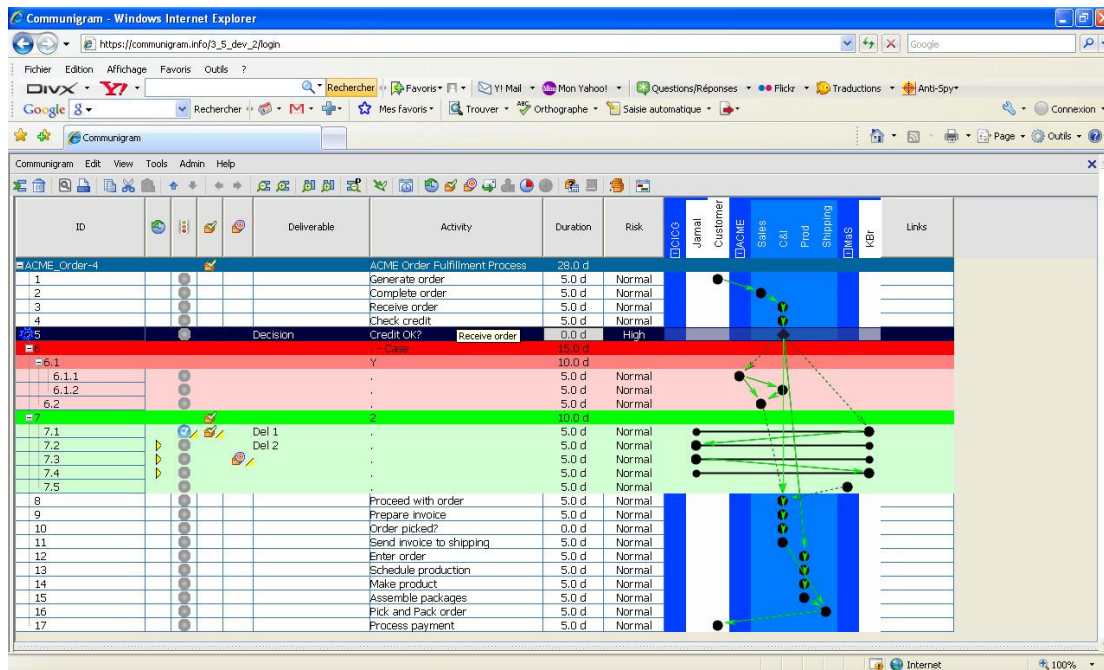

Figure 5: Alternative Solution Paths in Communigram

Alternative paths always start at a decision point (a.k.a. a milestone or gate) in Communigram. In the illustration above, the decision point is highlighted in dark blue (row is marked with the cursor). The red sub-project shows the alternative solution, while the "normal" case is shown in green.

2. Knowledge of actual risks during the project

Of course, it is not possible to anticipate all risks of a project. Unexpected events are part of daily project life. The only thing one can do about them is detecting them and initiating countermeasures as early as possible. Once again, this is done in a decentralized manner in BCE.

Each deliverable leader disposes of a personal excerpt of all running projects in myCommunigram that shows him those parts of the projects in which he is personally involved. Once a week he is asked by myCommunigram to state whether he and his team will be able to supply the deliverable in time. He will do so by setting a green, amber or red traffic light:

- Green: to our current knowledge, we will be able to supply the deliverable by the expected finish date

- Amber: an unforeseen event has occurred which means that we will not be able to finish the deliverable by the expected finish date

- Red: an unforeseen event has occurred which means that we might not be able to supply the deliverable at all

Amber and red traffic lights need to be commented. The problem leading to the traffic light needs to be described so that all people concerned can understand the reason. This comment is automatically made visible to these people via myCommunigram.

3. Management of Risk

A third aspect of risk management is, what to do when a risk does indeed occur. Fast, decisive action can often attenuate the negative effects. The BCE methodology contains a clear rule set on how to act in these cases. These rules need to be adapted to the organizational environment, but in most cases, amber or red traffic lights call for a change of the project plan. This process is a.k.a. "Living Planning" in the BCE methodology. In order to support quick changes when they become necessary, Communigram provides advanced scenario analysis, shown in Fig. 6 below.
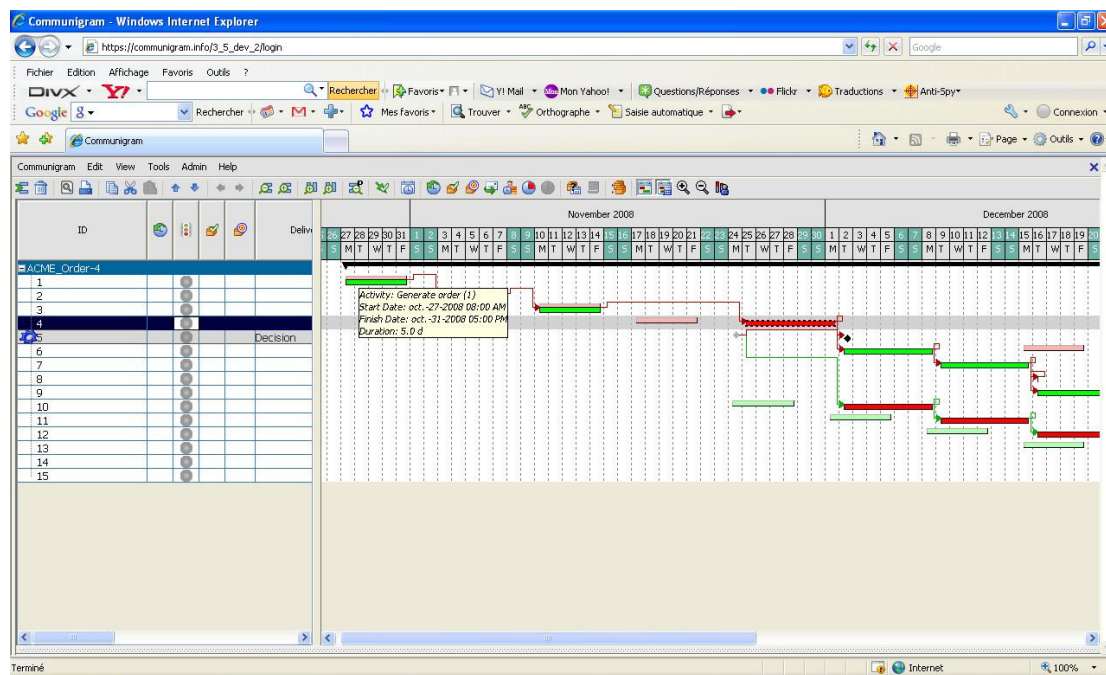

Figure 6: Risk Management – Scenario Analysis in Communigram. The Effects of Projected Changes in the Project Plan Are Made Visible.

Here is how the scenario analysis works. The leader of a deliverable has signaled, that a severe problem has occurred during its elaboration by setting an amber traffic light. The project manager now calls in a planning meeting. During this meeting, various possibilities are discussed on how this problem could be solved. These potential plan changes are entered into the Communigram. A Gantt bar may be shifted to simulate potential change and highlighted with dashed lines. Communigram automatically calculates the effects of this change and makes them visible with full colors, while the original plan is illustrated with light (pastel) colors. If the plan changes are decided, then the simulated plan is turned into the current plan and replaces the original one.

The Eighth Dimension: Communication between Projects

The eighth dimension is the spatial representation of a large project that is composed of multiple projects and sub-projects that in part take place in independent organizations and at different sites.

The development of many technical innovations is planned with a methodology that is derived from Taylor's concept of work division. The final expected result of the project is divided into its subparts, which then are handled as independent project results. This approach has advantages that have ensured its survival: it bundles technical competencies within the

subproject. Subprojects possess an arborescence of unlimited depth; they can contain as many subprojects and sub-subprojects as deemed necessary. This enables the creation of easily manageable project sub-entities.

However, this approach also holds a grave problem, i.e. the planning of information exchange between the subprojects. In other words, the planning of the interfaces between the subprojects creates difficulties. All previous attempts to master them have delivered unsatisfactory results or lead to the typical catastrophic time and cost overruns of large projects that have been abundantly reported by in the press. The usual reaction of setting up cross-subproject "coordination teams" creates as many new problems as it tries to solve, because:

- The coordination is performed through countless additional meetings that cost incredible amounts of time and money

- The central problem of these coordination efforts is however, that the planning of the coordination is not properly integrated in the detailed planning of the overall project

The most efficient, time-saving method to solve this problem is to once again integrate these aspects using the "Supplier-Client" approach.

As described above, the deliverable leader must make sure that he will dispose of all inputs he needs when work on the deliverable is scheduled to begin. This concerns of course also all deliverables that are elaborated in other subprojects. Therefore, he will add any input requirements in the corresponding window under the target of the deliverable.[11]

He and his subproject manager will make sure that this requirement is communicated to all other subproject managers concerned. The inclusion of the corresponding deliverable in the "foreign" subproject and the delivery of this result to the own subproject becomes visible in the Communigram.

The planning of the interface between subprojects, wherever these may take place, therefore becomes integral part of the project planning procedure.

So far so good. The trouble is that this type of plan can currently only be displayed in two dimensions on a page or screen. This means that projects taking place simultaneously can only be modeled sequentially. The great number of necessary communication arrows can lead to an illustration that is quite difficult to read.

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[11] Satisfying the requirements of one subproject in another subproject is also called transversality.
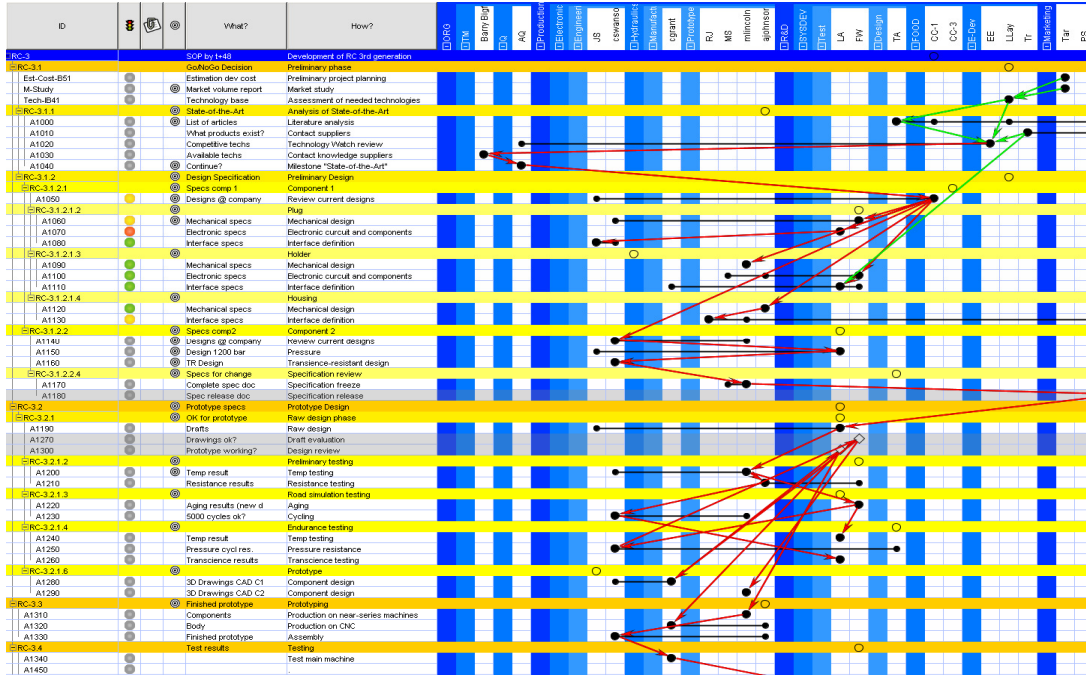
Figure 7: Small Excerpt of A Complex Project

The entry of the corresponding arrows in a large project plan could also create difficulties. Experience has shown that "scrolling" is something people hate so much it can actually preclude planning. In Communigram, this problem was solved as follows: [12]

Even a Communigram holding several thousand lines and hundreds of people can be collapsed efficiently so that it consists of only one row and only the columns that represent the groups of the participating people. Fig. 7 shows only two of 50 subprojects and within these only the contribution of the R&D department's sub-entity E-Development to these subprojects.
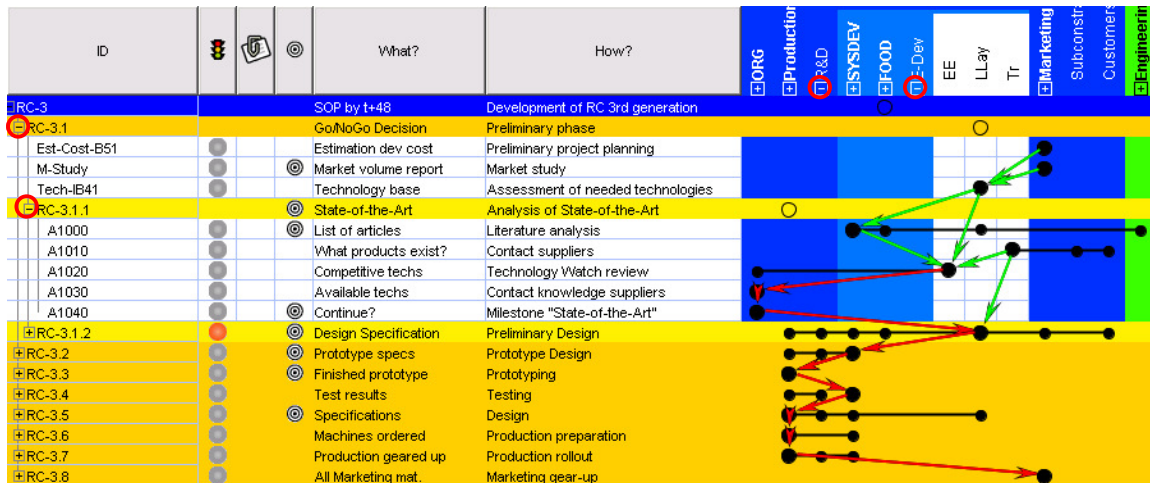

Figure 8: The Communigram of Fig. 7 collapsed. Communigram automatically recalculates all communication links: the connections become visible, the overview is intuitively comprehensible.

Now it is a question of entering the transfer of a deliverable as an arrow between two deliverable leaders that could be yards apart in a completely expanded Communigram. To do so, a "magnifying glass" is used that allows expanding only the two concerned subprojects and the two groups of people in such a way, that the two crossways between leaders and

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[12] Patent

deliverables appear. Even the smallest computer screen can do this. In this manner, the arrow can be simply entered and it represents the transfer of the deliverable. This is shown in Fig. 8.

The project in Fig. 9 is still in the planning stage. The entire process of a drug development is already available as a list of deliverables. The project will take several years to complete and includes thousands of deliverables whose elaboration will occupy hundreds of people. Now for example, it could be necessary that a summary report three years from now requires information that is created at the beginning of the project. The transfer of this information is shown through an arrow that goes from the top left corner all the way to the bottom right corner.
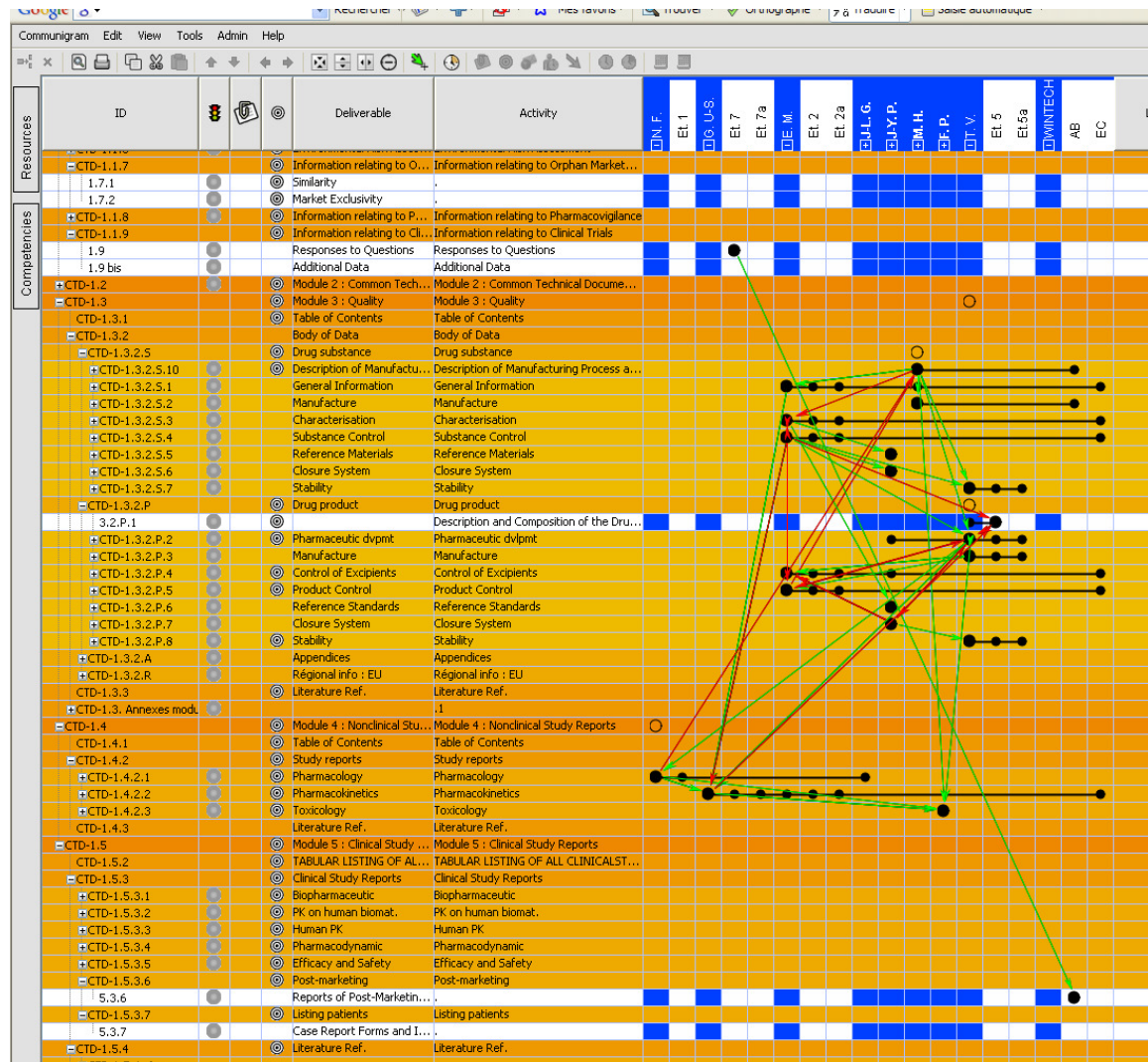

Figure 9: Two Parts of the Communigram expanded. They are three years apart in time, yet they are connected with an arrow that ensures the transfer of the deliverable.

Should this deliverable have more than one Client, this process is repeated, so that all Clients can be satisfied. The arrow also opens a communication channel between the two that enables the attunement process between Supplier and Client via myCommunigram, should they not be able to participate in the project planning meetings.

These communication links of course remain active, regardless of the fineness in which the communication links are displayed in the Communigram. This means that even if the arrows are hidden, all communication channels remain open, and deliverables will be transferred as the most detailed arrows show.

The Future: Spatial 3-Dimensional Planning Representation of the Eighth Dimension

In principle, it is already possible to represent the eighth dimension in the Communigram, since independently planned projects can be shown next to each other on a sufficiently large computer screen. This allows interweaving the two Communigrams and to plan the interface between the two using the Client-Supplier linkage. Arrows connect the two projects.
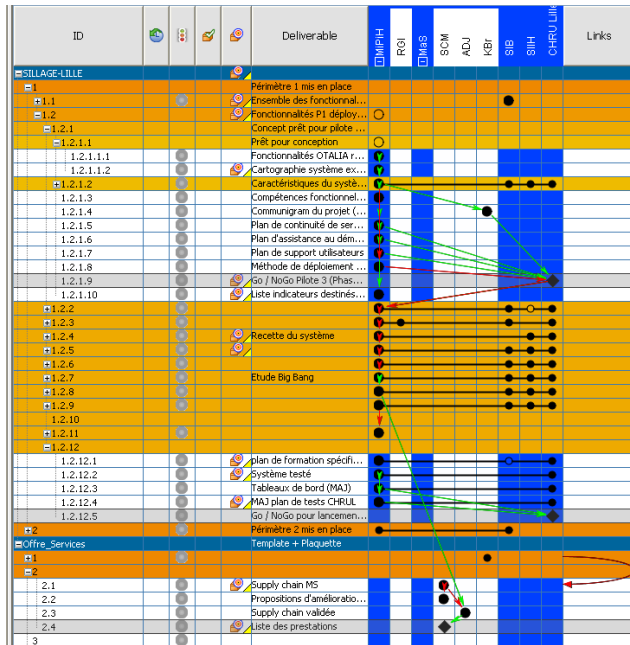

Figure 10: Two Communigrams "Sillage Lille" and "Offre Services", which are connected with arrows

Of course it is possible to interconnect many individual projects by bringing them up on the screen in pairs, using the magnifying glass to open the right parts of the projects and organizations, and then drawing the arrows. A far more elegant solution is shown in Fig. 11 below.
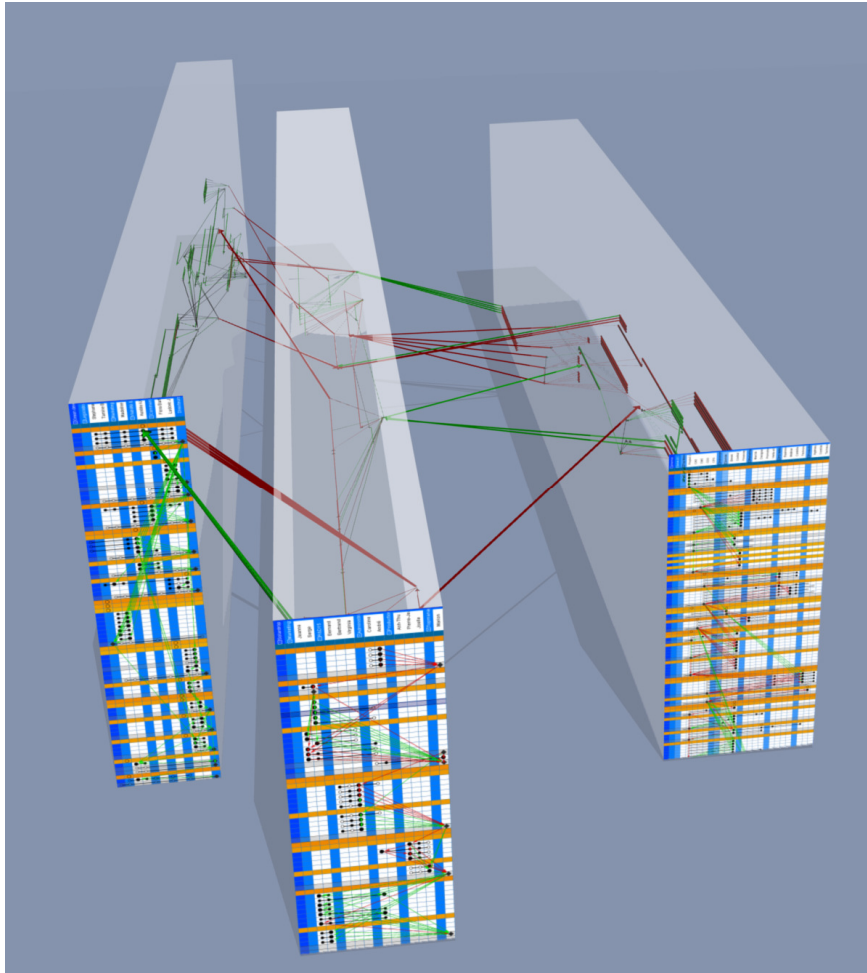
Figure 11: Three Dimensional Representation of a Large Project with Interconnections between Two Subprojects

As many projects needed can be displayed in this 3-dimensional space. They can be connected with Supplier-Client arrows. Note that each Communigram is already in 3D: people, deliverables and time.

Conclusion and Outlook

The introduction of a planning method, which integrates all 8 dimensions at once, represents a big challenge. Experience has shown that it is only possible, if Top Management fully supports such an endeavor. This, however, is not sufficient. It is also necessary to motivate at least the greater part of the people planning and executing the project plans so that they accept the new method enthusiastically. It is for this reason, that the BCE method contains a certain number of personal motivators. They convince people, that their personal advantage when using BCE is greater than the effort they have to make in order to master the method. The detailed and smart planning that is connected through communication paths leads to a much faster implementation of projects with fewer conflicts then usual and in much higher quality. All documentation is immediately documented in a context, so people understand their usefulness. Communigram connects people worldwide and across companies with a common method that is independent from language, hierarchies and departments etc. ! The Transparency regarding the status of the projects make it much easier to manage, also to manage proactive.

The quantification of the economic consequences of the use of BCE is difficult. For this, it would be necessary to compare two situations: the real one, which quantifies the actual financial outcome of a BCE project and a hypothetical one: What would have happened

financially speaking, had we managed the project without BCE. Many other parameters could also have had an impact on improved performance. In this situation it's the personal opinion project executives, which can be used. However, those, which we have been able to collect so far, give spectacular figures in terms of gain of productivity.

The operational use of the planning of the communication between projects and subprojects in a three dimensional space is in work. Great progress will be possible once three-dimensional TV technology will be available.