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Guest Editor: *Julián Marcelo-Cocho, Antonio Teti, and José-María Torralba-Martínez*

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Driving Projects by their Risks

Julián Marcelo-Cocho

The extension of the Theory of Project Management for highly uncertain projects leads to a Method of Project Driving that is based on Project Risk Management (risk as deviation from the objective) with Critical Chain Techniques. The MadPRYX method includes these forms of planning and monitoring, but does not yet enable projects to be pro-actively guided "at sight" over the course of the project.

Keywords: Complexity, Effectiveness, Efficiency, Risk, Success, Uncertainty.

1 Is the underlying Theory of Project Management Obsolete?

This classic article on project management caused some anxiety when it was published in 2002 [1], and has since acted as a magnet for heterodoxy in the theories of project management, in contrast to the orthodoxy represented by PMBoK of the PMI [2].

The article applied to project management the "just in time" concepts from "lean" industrial production, as well as the Theory of Constraints (TOC). The article asked if the Theory of Projects should be seen as a flow rather than a transformation, including the time "affected by uncertainty" and the interdependence between tasks. Also included is the generation of value that eliminates unnecessary resources (so as to reduce uncertainty), and maintains the client's requirements as a business aim. The resulting conceptualisation would complete in this manner the transformation view with flow and value views.

The article said Theory of Project Management can be divided into three sub-theories, Planning, Execution and Control. The planning model of management-as-planning is not sustainable, and should be changed to management-as-organizing (including the environment and operation). In execution, unreal launches (with the availability of all needed inputs and resources) should be changed to a system based on a "language/action perspective". Control has outgrown the "thermostatic model" while looking for causes of problems and seeking to improve performance with the use of "on-hand" resources.

The evident anomalies "*or unanticipated results observed in the use of methods based on the theory indicate that the implicit theory of project management is not empirically valid*". The article concludes that "*project management has not achieved the goals set to it: it does not perform in a satisfactorily way. In small, simple and slow projects, the theory-associated problems could be solved informally and without wider penalties. However, in the present big, complex and speedy projects, traditional project management is simply counterproductive; it creates self-inflicted problems that seriously undermine performance*".

Scientific understanding advances by studying anomalies. For example, an explanation of the anomalies in the theory of gravity led to the theory of relativity. With regard to risks management, the Theory of Management represented by PMBoK continues to be useful for many projects, and even projects with a **high complexity X**. However, projects with **high uncertainty Y** require an underlying theory more reactive and supported by TOC.

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2 Uncertainty, Buffers, Critical Chain, and Launch

The practical application of this new theoretical vision shall understand three mechanisms that waste buffer resources (for example, those resources that absorb project delays). These mechanisms are: "*the (bad) student syndrome (starting at the last moment); multi-tasking; and dependencies between tasks causing delays to accumulate and ensuring that advances are lost.*" To neutralise these mechanisms, each step is analysed with "*the maximum priority being given to those tasks that reduce the buffer of a project, either because they are somewhat delayed and form part of a critical path; or because they are so delayed that they might consume the buffer and so affect the critical path even though they are outside the critical path itself … and later the tasks that consume their own feed buffer but do not affect the project buffer"*.

In the new model of Critical Chain Project Management (CCPM), an analysis of the causes of delay is based on the prioritised set of tasks. The CCPM method changes the techniques of preparing the stages of planning and monitoring; but not the tasks and processes of project management set out in PMBoK'04.

During the **planning stage under CCPM**, the plan is developed from the objective date backwards, and each task is begun as late as possible, so reducing the duration of each implicit task buffer hidden in the estimation (as the bad student syndrome wastes time and renders useless the protection offered by the buffer for any local incident, or "*murphy*", caused by uncertainty). The durations are regrouped in explicit buffers to absorb the time delays imposed by global murphies that may cause a global delay. These are inserted in the key project milestones, as determined by the critical chain tasks (which deals with dependencies between resources, as well as those dependencies between tasks handled in the critical path). A buffer is so obtained for the whole project, with the feeding buffers at the end of each chain feeding a critical chain. This offers protection from local deviations in the chain (the size of the calculable buffers explicitly takes into account the variations in the implicit buffers in each task.)

In the **monitoring stage of a project with CCPM** the plan is followed to its final objective date and, in a similar way to that of the critical path, the buffers are administered and the final date remains unchanged until the project buffer is consumed.

[1] Two tools are being developed: *MAGERIP* for the planning stage, and *Scoreboard MadPRYX* for monitoring.

[2] In addition to Hall, the brain maps produced by Herrmann (Whole Brain Technology) have influential followers such as Mintzberg (cited in "Mintzberg on Management" The Free Press, 1989) or Webster ("Whole Brain Management for All"); and equally influential sceptics such as Simon. In this article, these maps have only been metaphorically taken, after confirmation of the level of support for the affirmations made by Hall by well known authors such as Carter ("Mapping the Mind". Orion, 1998). The brain is totally interconnected and the quadrants only indicate complimentary functional areas, rather than tendencies or inclinations of any type.

3 Knowledge and Risk

The central importance of complexity X and uncertainty Y in the third generation of Risk Management [4], has led to the design of MadPRYX (*a **Model of Adaptation and Driving of Projects by Risk, uncertainty Y, and complexity X***). MadPRYX's first outline was presented in 1999 [5], it was further developed in 2001 [6]**,** and obtained sufficient theoretical support and teaching experience to be considered finished in 2007[1] .

The MadPRYX model starts from the **Hall project management risk model**[2] [7] which links basic organisational and intellectual functions normally localised in specific areas of the brain. The Hall model contains six disciplines PPMMDD and four function and knowledge quadrants (covering dynamic/static and long-term/short-term issues), which correspond to the four gnostic temperamental and organisational "circuits" MMP-PPM-PPD-DDP, related in this case to the general driving of projects (see Figure 1).

- The occipital left region holds the **memory** of the **past** and this has the following influence on the disciplines of MMP (Measure-iMprove-Plan): experience learnt in previous projects offers a long-term perspective to foresee prospects in a practical, consistent, and programmed manner. Experience also helps develop plans and detailed procedures; organise essential data; and maintain their given path. Whoever mostly uses this quadrant is seen as temperamentally organised, sequential, disciplined, and good with detail.
- The frontal left region holds the **logic** of **known** and this has the following influence on the disciplines of PPM

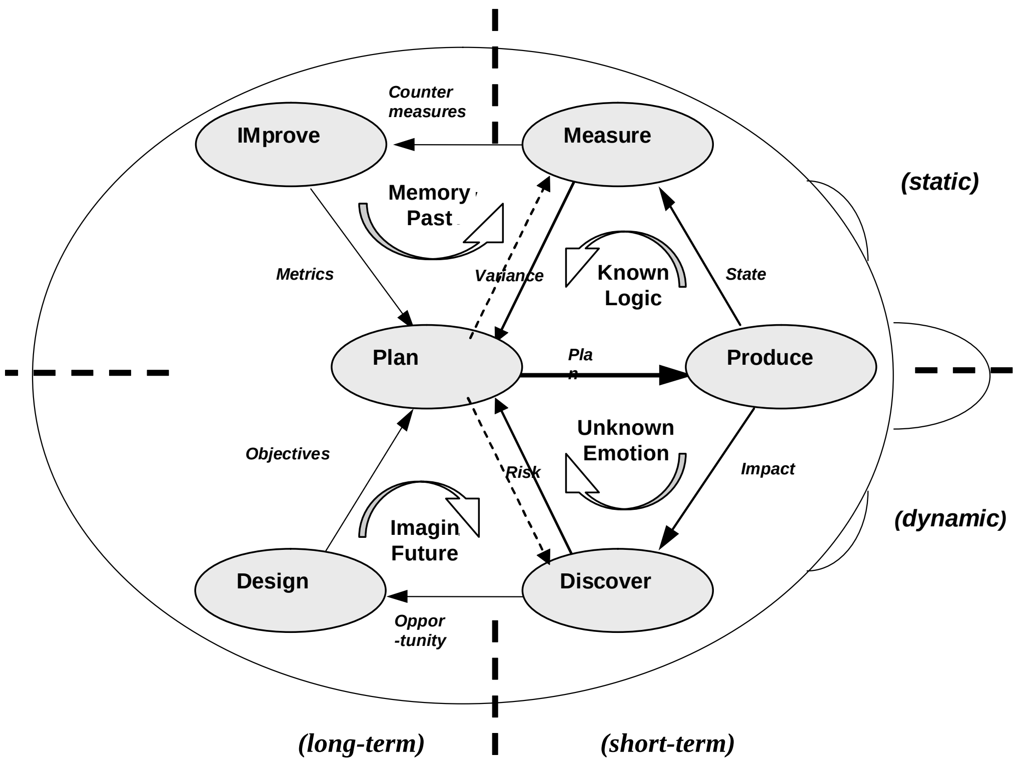

Figure 1: Cerebral Map showing six Disciplines, four Quadrants, and four Circuits (source: Hall and own development).

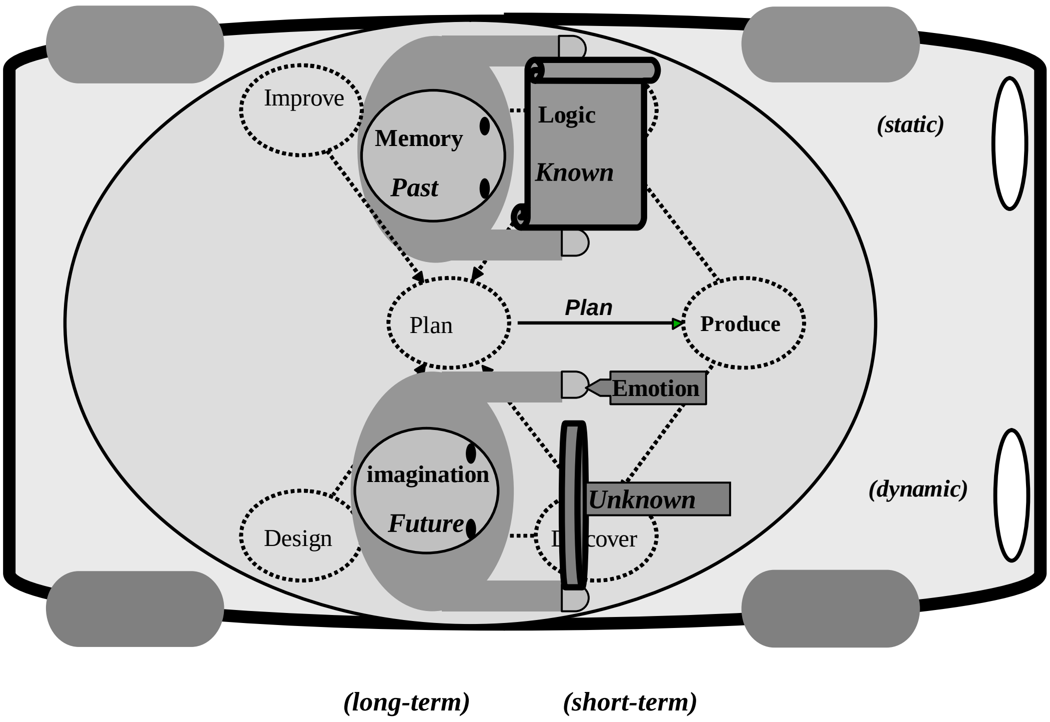

Figure 2: "Rally" Driving using both Brain Hemispheres (source: own development).

(Plan-Produce-Measure): it collects facts, analyses results; resolves problems in the short-term; reasons with the facts; and understands the situation and emphasize the differences with respect to the plan. Whoever mostly uses this quadrant is seen as temperamentally fact-based, logical, rational, and theoretical.

■ The frontal right region holds a sense of **emotion** regarding the **unknown** and this has the following influence on the disciplines of PPD (Plan-Produce-Discover): it provides a short-term perspective regarding parts of the plan and production to be investigated; explores the requirements or technologies and its possible impacts on the plan, resolves problems intuitively; observes signs of imminent change; perceives anxiety about the unknown and redirects that anxiety to new possibilities and panoramas; tolerates ambiguity; integrates ideas; and defies established policy. Whoever mostly uses this quadrant is seen as spiritual, emotional, and empathetic.

■ The occipital right region supports **imagination** of the **future** and this has the following influence on the disciplines of DDP (Discover-Design-Plan): it provides long-term perspective on the circumstances; sees and capitalises on opportunities; develops a prospective vision based on own discovery; conceives new ways to live; considers values and generates enthusiasm. Whoever mostly uses this quadrant is seen as holistic, flexible, imaginative, artistic, and inclined to synthesize.

4 Strategy for Driving Projects by their Risks

The complexity X of an information system (and the complexity of the software to be developed) has received a great deal of intuitive attention; without an in-depth study of its conceptualisation. Uncertainty Y is only beginning to be explored laterally and this hints at the "Project Driving" concept (including Planning and Monitoring during Execution).

The model MadPRYX has gone a step further than the brain metaphor, and uses motor-racing metaphors when discussing the execution of project guidance. Within these metaphors, the Projects are vehicles, their development Environment is a racing circuit, and the Project Managers are drivers.

- In "***formula races***" we use delicate and complex machines with sophisticated features on specially prepared circuits with predictable risks (including perhaps a "killer curve").

- In "***rallies***"we use robust vehicles on approximate and uncertain routes, with circuits no or only slightly prepared (such as the Paris-Dakar), and full of predictable and unpredictable risks.

4.1 "Formula" Strategic Model for Driving Projects

A single driver-manager can handle a highly complex project, providing the circuit only contains ***predictable variations*** (curves more or less risky), and providing that the environment does not contain ***unpredictable uncertainties*** (metaphorically, the circuit must be surrounded by an insurmountable crash barrier).

Although the driver uses all of his mental capabilities, he is basically using short-term frontal functions; whether to remember with the left hemisphere the logic of a "known circuit"; or to anticipate an unknown factor in the curve ahead using the right hemisphere and adapt driving to the circuit (the predictable reference that structures the whole project). In this way, he can centre all his attention on indications of the vehicle behaviour to guarantee the success of the project (with policies and contingency plans to respond to predictable, but updateable events such as breakdowns, punctures, fire, etc.).

4.2 "Rally" Strategic Model for Driving Projects

Rally-style driving takes place on highly uncertain circuits and environments, with predictable and unpredictable risks, and requires two directors, or at least, two functional directives (see Figure 2):

- The co-driver preventively monitors the circuit and its environment by reading a map. He tells the driver about the known risks on the circuit (predictable uncertainties) having acquired this information before the race as part of the planning process. In this way, he uses the functions of "memory of the past" and "logic of known" found in the left hemisphere of the brain.
- The driver incorporates as "imagination of the future" the preventive indications of the co-driver (predictable uncertainties); and performs the long-term manoeuvres (gear and speed changes). However, the driver uses the right cerebral hemisphere capabilities to handle the unknown (unpredictable uncertainties) that may arise, and reacting with the brake and steering wheel.

Rally-style driving is best used in projects with great uncertainty, where the correlation of the functions of the driver and co-driver and the functions of both hemispheres are reflected and handled (according to the resources and capabilities available) by a team of specialist managers; or by a single manager with an uncommon ability to realise both functions, and capable of differentiating and combining the roles of driver and co-driver[3].

5 Basic Characteristics of the MadPRYX Model

The MadPRYX model collects the two project guidance strategies of formula and rally, and works by means of some functions included in the canonical development of any project (represented as a sequence of stages, as in PMBoK):

- ***start function*** includes search and selection of all the possible information about the project and its environment and establishes an external objective for the project; assuring the viability of the objective (in clarity, scope, and resources), and a project development structure that enables the use of MBO (management by objectives).
- ***planning function*** proactively prepares contingency plans and safeguard policies to prevent predictable risks, and respond to their appearance with the necessary resources (including buffers).
- ***monitoring (of production) function*** reacts to alerts (established in previous functions) with planned countermeasures (the policies deduced in the contingency plans for predictable uncertainties), and generic resources (buffers and others); and resolves unpredictable uncertainty. This function has the necessary flexibility to respond to unpredictable errors using learning buffers.
- ***execution function*** includes tasks reserved for the project director handled in parallel with his task of monitoring the production team operations.
- ***closing function*** gathers experiences and project metrics to prepare for the application of new parameters to successive projects -as learning for predictable risks.

During the stages of execution and monitoring, given the constructive necessities of the content of the project, the previously listed functions can, in the case of a highly complexity X, be reiterated with respect to the itemised **modules**, or the prototypes designed to reduce the high level of uncertainty Y. MadPRYX can be described in teaching terms as an "ABC" model, as below:

- ***Ample model***, embracing all the phases and functions of a project in an wide sense, from its first mention to its definitive acceptance; including tenders and contract, possible orientation to service and association to all types of evaluation methods.
- ***Bilateral model,*** gathering the interests of all participants (clients, developers, users...)
- ***Complete model,*** calculating the project risks (in order to classify threats and critical events) and using the causality threat-countermeasure to develop contingency plans for predictable events, and incident policies for unpredictable events (including the change of milestone dates).

In MadPRYX, as in any risk process, the safeguards are applied in an environment of "persons" with "three I" contexts:

- ***Interested context:*** any change process affects established situations or interests.
- ***Internal context:*** where the main affected interests are found in a reduced area of relationships generated by the project itself.
- ***Intelligent context:*** referring to the contradictions and counter-actions of highly defined actors with unequal powers, requiring sufficient flexibility from the director to adjust to the situation and enough authority to avoid any project ineffectiveness that could compromise its success.

MadPRYX trys to control the situation of each factor that may contribute to the project's global risk with the "three R" focus, that is:

- ***Residual control:*** maintaining the factor values under a defined and revised threshold.
- ***Repeated control:*** reiterating vigilance and intervention if a situation may become out of control.
- ***Registered control:*** conserving the trail of events in order to learn and transmit information to other projects.

6 Proactive Project Driving

Beyond the intuitive image that the "rally" concept facilitates, project driving with help from risks in any incident generated by environmental uncertainty (a "murphy") continues to be reactive and clearly adaptive. That is to say:

[3] Both models of driving also correspond fairly well with the characteristics of the uncertainties and the tasks of the managers that a team from INSEAD (Meyer et al.) have described when proposing a choice between the two major project management strategies: the "proactive" planning strategy; and the "reactive" response strategy (alerts) and learning.

the driver reacts to the incidents as they occur by adopting the adequate measures, thanks to a buffer of resources reserved for these risk situations.

But normal human driving "by sight" supposes not only a reactive step with respect to the project's environment, but a proactive step with respect to the project itself; learning to use a "map" (project plan) when analysing a situation, while resolving small and immediate incidents are resolved mechanically.

The ***planning function*** in a situation of high uncertainty Y, is converted in any sense into a phase of "mapping" that; firstly, shortens the trip to the immediate "journey" ahead with a certain and precise objective (meaning a sub-project or prototype, hereby baptised "***protoject***"); and secondly, virtually achieves the objective and so places the "*protoject*" in the context of the project. The breakdown of the project in tasks changes to becoming a set of iterations, or protojects, that are structured according to the most convenient segments and milestones from the point of view of the resolution of uncertainties (that is, predictable incidents). The "danger map" establishes the most dangerous areas and the most adequate driving measures (for example, speed limits, extra resources to climb "hills", environmental attention frequency, reviews, etc).

The ***monitoring function*** is based on a comparison between what is indicated on the "danger map" (the co-driver or something like an audio GPS system), and what is "at sight" in each planned interval of the protoject. This comparison requires the availability of a set of parameter measurers and measurement activators organised as a Balanced Scorecard; as well as interconnected between them (with measurement and action parameters adjustable as the project advances, in a similar way to automatic transmission or "softness" of the suspension).

The "by sight driver" must maintain a global awareness of the project, as well paying precise attention to the instruments and course, as suggested in the Theory of Constraints underlying Critical Chain Project Management. The progressive exhaustion of the "major resource reserve" (energy in the case of a vehicle) maintains a good level of efficiency in the project; while the "small reserves" (including the activator's space-time margins) enable rapid rectifications required by the relevant contingency.

7 Risk Management and Project Success Factors

A study of the Critical Risk Factors of a project dualizes the study of the Critical Success Factors: taken as a result of fulfilling the objective in a way that is factorizable and measurable with two criteria:

- ***Effectiveness*** is an "external" criterion of result comparison with the objective established outside of the development of the project; a qualitative criterion (client satisfaction, for example) that implies sub-criteria which are difficult to validate and rarely validated.
- ***Efficiency*** is an "internal" criterion of result comparison with some reference related to the limitation of resources used in the project, or with the causes of its potential defects. Its measurement is quantitative or qualitative, and more or less subjective; but it can be referenced to the degree of advancement achieved by the project, which can, in turn, be determined by material and immaterial resources used by the participants.

These two criteria are not independent, but rather disynergic or negatively synergic.

- ***Efficiency*** is more controllable, but impacts on lack of effectiveness when certain resources are unavailable.
- A strategic ***ineffectiveness*** (abortive shortages) conditions the interest of any tactic efficiency.
- Even in well organised projects without abortive shortages, a risk of minor non-fulfilment may produce an impact that always requires an increase in resources (meaning a controlled reduction in global ***efficiency***) in order to redirect the project towards the objective.
- In general, to achieve a certain level of ***effectiveness*** (or a threshold of risk represented by a limited distance between the result and objective), the level of ***efficiency***, or used resource, depends on the levels of uncertainty Y in the development process, until the maximum level of ***inefficiency*** implied in abandoning the project. Before arriving at such an unsatisfactory decision, the lowest possible consumption of resources will minimise waste and reduce inefficiency.

In short, MadPRYX looks for success in the optimal equilibrium of these criteria of *effectiveness-efficiency*: as conditioned by the levels and types of *complexity-uncertainty* in the project process and its environment.

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