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IMPACT ON R&D OF SECOND ORDER EFFECTS IN THE INNOVATION PROCESS [1]

✸ In the 80's R & D will be increasingly impacted by what could be called 2nd order effects in the innovation process.

For instance, while in the past R & D programs were either motivated by
a) the technology push or,
b) the need's pull
it is now more and more dependent on the two motivations a x b acting together, tending to accelerate the intrinsic pace of the innovation process.

Among the effects of the 2nd order motivation: it is more and more difficult to decide on R & D within a company belonging to one industrial sector. Cooperation and joint decision making will be required between, e.g., materials and parts producing companies with those which manufacture final products.

Increasing complexity in R & D will result also from the need to develop innovative solutions not only at subsystem level (such as at component's level in a product, or process's level in manufacturing) but at system level.

In a certain sense, the innovation process is changing from an “open loop” type process to a “closed loop” process with strong feedbacks from the need's pull trying to modify the research phases before their completion. Few examples will clarify better the issue.

✸ Two-phase steel has been developed as a high strength steel on the basis of technology push. The Japanese steel industry has to renovate their manufacturing plant just in phase with the availability of the innovation, and decided to introduce continuous heat treatment of steel plate after lamination to put on the market a product better (surface finishing and strength) than conventional steel but costing almost the same.

The automotive industry in Japan well accepted the 2-phase steel put on the market by the steel industry. There have been no-apparent interaction between the two sectors: the innovation process was of the “technology push” type (from the idea to the new material, to the production, to the market, to the use in the final product). In other words, an “open loop” innovation process.
Now days in Europe, the need to reduce weight in the car is “pulling” for low cost high strength steel. European steel making industry are not prepared to produce it, and high investments are needed to transform existing production plants.
The “need's pull” has identified an existing “technology pushed” innovation and it is trying to accelerate the process of innovation. The difficulty depends on the fact that steel industry, to decide to accelerate the new investments, requires engagement from the user industries for fixed quantities at a given price. The decision taking is “bouncing forth and back” from one industrial sector to another.

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[1] FIAT Research Centre. Internal memo, July 6,1981

How will this situation impact R & D programs?

- Plastic use in car has grown steadily for non-structural parts applications, taking advantage of new materials progressively put on the market by chemical industries. Cooperation between chemical and automotive industries, thaugh important, has been more of the “application engineering” type than R % D.

  The need to reduce weight is forcing to accelerate the availability of long-fibre reinforced plastics. This to be possible, requires joint R & D between the material producer and the user, at a stage where the new materials are still being developed in laboratories or pilot plants.
  The “research system” of the chemical industry tend no more to be a “closed system”, but an “open system” interacting strongly with the automotive “research system”.

- Oil industries developed the refineries according to the market needs.
  So, in USA more than 50%,of the crude oil barrel is transformed into gasoline, while in Europe (where heavy oil is used for thermal plant) it represents less than 25%.

  lf in the future more and more of the oil has to be used for transportation (in the other fields of use oil being substituted by other energy sources) the decision on the optimal form of the fuel percentage subdivision between gasoline and diesel oil (or the use of “large-cut” distillate) cannot be taken by the oil industry alone.

  The acceleration of the market development of the diesel automobile depends from the car industries, the government, etc.

- Innovation in traffic control is being introduced through the use of microprocessor. The traffic control system senses the vehicles and, combining with statistical information on traffic flow, operates the cross-lights. This can be considered as a “sub-system” innovation, the “traffic control” being a sub-system of the ”traffic” system.
  lf the traffic control-subsystem could interact with the “vehicle subsystem” to know, e.g. , for each vehicle the destination, an “innovative state” of the entire “traffic-system” could be conceived, much more efficient than the today traffic “system” innovative control technology. Unfortunately, the decision to modify the “vehicle subsystem” cannot be taken by the “decision makers” of the traffic control sub-system alone. Furthermore, R& D programs to prove the effectiveness of the “system” innovations are much more complex.