Predictive maintenance & common sense

Yes, super! … **But where is the technical and economic common sense?**

By its wording, this category of software informs in a very explicit way the function covered by its field of application, for any type of machine or equipment; taken, here, in a context of industrial production tool.

We can summarise the purpose of the application of these "*predictive maintenance*" software by saying that from the moment a machine or equipment (a series of machines contributing to the same production) has at least one part in motion in relation to a fixed part, there will inevitably be wear and tear, since by definition the two are linked by some means. In fact, predictive maintenance is economically justified since it consists in predicting the best time for preventive maintenance, before the machine breaks down. This implies an "on time" supply of the spare parts and a "planning" of the maintenance at the best time, in accordance with the production, so that this maintenance operation does not impact the production.

Logically, this "**predictive**" approach is more economical than **systematic preventive maintenance**; This is particularly the case when the industrial equipment is complex and requires a large number of different skills to be available.

In principle, the idea is marvellous!
It is the assurance, the guarantee, of a better world, without untimely breakdowns and with a known maintenance budget, which is easy to integrate into the cost price of production, with little uncertainty.

Nevertheless, it is necessary to look in detail at the "**who, how, what**".

For example, considering a simple machine with only two parts, one of which is in motion relative to the other, the first question to ask is whether this "moving" assembly has benefited from the best design and whether the interface between the two parts benefits from the best technology to reduce wear on one or both parts.

The design of this assembly, depending on the context, can be **very rustic** to **very sophisticated**.

In our very simple example, the quality of the assembly should be defined as a complete, multiple, one-way rotation that has nothing to do with an alternative partial rotation. The designer must take into account the mass in motion, the torque generated, the speed of rotation, the shape and material of each part, and the environmental characteristics of the machine. With his knowledge of the rules of the art, his calculations, his standards, his "habits and customs" and his budget, he will be able to define the design of the interface between these two parts, one of which is in motion. This interface will be without lubricant or with a lubricant, and if so, which one. It may or may not have a ring, a bearing, one or more bearings, a magnetic bearing, an air bearing, etc.

The synthesis of the previous paragraph is:

- "***Shouldn't we make sure that the machine complies with the rules of the art, prior to managing the maintenance with predictive maintenance software?***"
- The corollary to this suspicion of an ill-ordered strategy **is to know if the publisher of the predictive maintenance software** is, on the one hand, "**judge and jury**" and, on the other hand, **how and on what basis the maintenance predictions have been built and calculated**. This is the 2nd real question!

<u>Some examples to support the reflection</u>:

1. In the 90's I gave a training on the component's adjustment of conveyor in an underground mine. After 6 months, when the performance of the training was evaluated, a net saving of 30 k€, after deduction of expenses incurred for the upgrade of conveyors, on 1 production line only.
   - Based on this encouraging start, the mine asked me to provide theoretical training.
   - On this occasion, a maintenance engineer presented me with his "**predictive" maintenance table on conveyor rollers**.
     - The analysis of the various causes of wear and destruction showed that the predictions were wrong, if the causes of the damage were solved, which was done.
     - Since then, the service life of the rollers has been increased by a factor of 5 to 10.

2. A maintenance engineer had forgotten to budget for the replacement of 3 km of 27-year-old belt, which put him in a difficult position. My intervention removed all the causes of the damage inflicted on the belt, for a budget of ≈50 k€, by correcting design and adjustment errors.
   - When the belt reached its 33 years, 6 years later, the maintenance replaced only 1.2 km of the total 3 km length.

3. A large belt with sidewalls and buckets, installed on a large 2-elevator, after 4 years of service, showed significant damage to its edges.
   - At the same time as repairing the edges, we eliminated the design errors most damaging to the belt and adjusted the components of conveyor.
   - The customer changed his tape 14 years later... to avoid taking risks; but it could have been used for several more years.

4. On a 25 km long belt, the operator regularly changes sections, following scanner inspections of the steel carcass. The total number of section replacements is equivalent to replacing the entire belt every 13 years for the past 40 years, when a state-of-the-art conveyor would allow a belt life of at least 50 years... This would not be good news for the belt manufacturer and the "scanner" service provider.
   - However, more than 10 years ago, I informed maintenance of the causes of the damage. As for the "scanner" service provider, he only indicates the weakened belt sections and nobody tries to find out "why"... for 40 years!
   - A predictive maintenance software, backed up by an A.I. (artificial intelligence), would indicate the n° of sections to be replaced according to their age or the tonnage handled, with no better performance than the scanner solution, probably at a lower cost.
     - But in substance, the origin of the damage would not be made more obvious and thus the causes would not be corrected to stop the damage.

5. Following two training courses, led by myself, on conveyor technology and their adjustments, a simple technician, rich in common sense and method, undertook, against all odds, to eliminate, step by step, the main and secondary causes of damage to the belts. In 8 years, the annual belt consumption has been reduced from more than 15,000 m to less than 5,000 m. In addition, there are many savings on pulleys, rollers and energy consumption, etc.
   - Bravo to this true "maintenance professional".

I have many examples, each more relevant than the last, to demonstrate that, in addition to the convenience of budgetary and operational planning by predictive maintenance software, it is imperative that the software be able to recalculate its predictions on the basis of updated data... to realise, in the end, that a simple spreadsheet is enough to establish a safe, effective and very economical maintenance plan, at least for belt conveyors.

Which is to say: "*don't put the cart before the horse*".

If it seems logical that the designer and manufacturer of the equipment is also the publisher of the predictive maintenance software, since he can feed the databases of his software with his resources, the said logic is not so obvious if the conditions of the "good application of the software" impose on the operator of the equipment to get spare parts from the manufacturer and owner of the software.

Going further, one can also imagine that the manufacturer makes no effort to question his machine designs to bring them up to the best level of the state of the art, since his interests are linked to the sale of spare parts. This is all the more true if the manufacturer enjoys a good reputation; it will be difficult for him to contradict himself by admitting his design errors (ask for my anonymous examples).

To avoid, at the very least, this problem, it is necessary to ensure that the operator of the equipment is not "bound hand and foot" to the manufacturer of the software, by requiring a list of spare parts available from third parties approved by him.

Conclusion

Yes, there is a real industrial and economic interest in the use of predictive maintenance software for complex equipment, which, in my opinion, does not include belt conveyors, taken in a "maintenance" approach.
With the same budget, would it not be more relevant, logical and economical in the long term to require conveyors that comply with standards and rules of the art, with an optimised design and whose "maintenance" management would be done on a simple spreadsheet. In addition, it would be appropriate for the belt of strategic conveyors to be monitored by video, coupled with an image recognition system associated with an automatic comparison with its database of typical defect images, because a break suddenly does not occur.

Bear in mind that the life of a large belt is more than 30 years, during which time the original predictive maintenance software will have changed many times.

In conclusion of the conclusion, that the engineers and technicians of conveyor field take back control of their machines.