INFORMATION SYSTEMS AND PERFORMANCE: THE CASE OF “TOUR DE FRANCE” RACING CYCLISTS

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France
“It is true, I’m attached to traditions, but now sprinters climb better than before, and know exactly where to situate the breakaways through their headphones. At my time, it was more diffuse, more difficult to organise the pursuit.”

Eddy Merckx (March 2007 after Milano-San Remo)
Do headphones (as information systems) in a cycling competition reduce the quality of the sportive show?

This research analyses the results of twelve Tour de France competitions in order to compare the gaps at arrival between the riders before and after the introduction of developed information systems.

Developed information systems for professional cycling include the use of radio links between riders and team managers (headphones), TV screens in the car of team managers, GPS localization for instant measures of gap between riders, SRM,…
Why is cycling strategic?

- Organizational logic: teammates protect their leader
- Maximization of the physical resources
- Multiplicity and evolution of the objectives
- Coopetition, alliance
- Importance of coordination
Information Systems in organizational management

- Information systems can be defined as a set of interrelated components that collect, process, store, and distribute information to support decision making and control in an organization.
- Information systems can help organizational actors to analyze problems or to understand complex situations.
- Informational uncertainty decreases with the use of information systems and we can suppose that actions are more rational.
- Literature on information systems assumes that information systems improve decision making, and because organizational actors receive more accurate information on time, they become much faster in decision making.
Communication during the race

Diagram:
- Rider
- Race’s fact
- Team Manager
- Information
- Exchange
- Reaction
- Instructions
- Adjoint

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Information System during the race

Team manager → Rider

Radio Tour
GPS
Television
Discussion
Riders,…

Decisions

Headphone

Physical state
Psychological state
Cardio,…

Action
- Our research supposes that cycling teams are similar to organizations as they have formal structures and use resources to produce output (in our case: best individual classification by time).
- During a professional road cycling race, riders have better information at the right time to make a rational decision.
- We can suppose that the use of developed information systems had lead to the reduction of gaps between riders.
We can suppose that the grouping of riders may reduce the quality of the sportive show.

This issue is important for the organizing of competitions.

Thus, the UCI or the ASO (Tour de France organizer) are examining the possible suppression of headphones in order to permit to create uncertainty during the courses and thus to favour the interest of spectators.
Before and after Information Systems Introduction

2000 2001 2002 2003 2004 2005

Basical Information Systems

Rare use
Period before IS

Television, cardio, headphones, GPS, SRAM,…

Transitional period
(Not taken into account)

Systematic use
Period after IS

Developed Information Systems
Our assumptions

- We obtained the time for each rider of all stages from twelve Tour de France (245 stages and 40,130 individual times). Tour de France in 1991, 92, 93, 94, 95, 96 had no developed information systems and Tour de France in 2000, 01, 02, 03, 04, 05 had developed information systems.
  - A1- Since the systematic use of developed information systems, sprints are more frequent.
  - A2- Since the systematic use of developed information systems, gaps between riders (finish stage) are less important (time’s concentration).
Modeling

- Headphone, GPS, Television, ...
  + Developed Information Systems
  + Centralization of decision
  Reduce Uncertainty
  + Improvement of coordination
  and better allocation of resources
  + Sprints of the bunch
  are more frequent
  + Concentration of rider’s time
  - Quality of the sportive show

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Stages
(before IS / after IS)

245 stages during two periods

All stages (125/120)

→ Team Time Trial

→ Individual Time Trial (18/16)

→ Road race - Mass-start stages (107/104)

→ Flat stages (62/57)

→ Middle mountain stage (15/13)

→ Mountain stages (30/34)

→ Flat finish (88/84)

→ Mountain finish (19/20)
Method

- We counted the number of sprints of the bunch to win the stage between two periods (before and after developed information systems) and we compared the results through a Chi-square test (A1).
- We measured rider’s time dispersion for each stage and we calculated the coefficient of variation (ratio of the standard deviation to the mean expressed as a percentage) for the first thirty riders of each stage.
- We had to compare results between two periods for each type of stage (mountain, flat stage, individual time trial,...) with an independent-sample T Test procedure (A2).
Results
Our results show that contrarily to assumptions, the introduction of developed information technology did not improve stage finishes for the sprint of the bunch.

<table>
<thead>
<tr>
<th>Type</th>
<th>No sprint (success from an escape group)</th>
<th>Sprint (success from the bunch)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before IS</td>
<td>29</td>
<td>33</td>
<td>62</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>46.77%</td>
<td>53.23%</td>
<td>100%</td>
</tr>
<tr>
<td>After IS</td>
<td>24</td>
<td>33</td>
<td>57</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>42.11%</td>
<td>57.89%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Khi 2 value : 0.262 – not significant effect*
Sprints are a little more numerous but the difference is not significant.
Centralization does not allow a more important effectiveness of the team of sprinters.
A1 is not validated.
Our results show that contrarily to assumptions, the introduction of developed information technology did not lead to squeeze up the gaps between riders.

**Coefficient of variation for the first thirty riders of each stage**

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>CV before IS</th>
<th>n</th>
<th>CV after IS</th>
<th>Sign</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>125</td>
<td>0.65</td>
<td>120</td>
<td>0.78</td>
<td>Ns</td>
<td>Dispersion</td>
</tr>
<tr>
<td>Ind.Time Trial</td>
<td>18</td>
<td>1.94</td>
<td>16</td>
<td>1.77</td>
<td>Ns</td>
<td>Concentration</td>
</tr>
<tr>
<td>Road race</td>
<td>107</td>
<td>0.44</td>
<td>104</td>
<td>0.63</td>
<td>0.1</td>
<td>Dispersion</td>
</tr>
<tr>
<td>Flat stage</td>
<td>62</td>
<td>0.22</td>
<td>57</td>
<td>0.55</td>
<td>0.05</td>
<td>Dispersion</td>
</tr>
<tr>
<td>Middle mountain</td>
<td>15</td>
<td>0.76</td>
<td>13</td>
<td>0.82</td>
<td>Ns</td>
<td>Dispersion</td>
</tr>
<tr>
<td>Moutain stage</td>
<td>30</td>
<td>0.72</td>
<td>34</td>
<td>0.68</td>
<td>Ns</td>
<td>Concentration</td>
</tr>
<tr>
<td>Flat finish</td>
<td>88</td>
<td>0.35</td>
<td>84</td>
<td>0.6</td>
<td>0.1</td>
<td>Dispersion</td>
</tr>
<tr>
<td>Mountain finish</td>
<td>19</td>
<td>0.85</td>
<td>20</td>
<td>0.76</td>
<td>Ns</td>
<td>Concentration</td>
</tr>
</tbody>
</table>
More time dispersion for the road races (Flat stages and Flat finishes)

But dispersion is not valid for crucial stages (Mountain stages and Mountain finishes: major shifts in the general classification)

A2 is not validated
Evolution of average dispersion
(coefficient of variation average by year - first thirty riders of each stage)

Tendancy: dispersion increases

Before

After
Headphones are not guilty…

- Do headphones (as information systems) in a cycling competition reduce the quality of the sportive show?
  - Our results show that this is not the case (taking only into account the gaps at arrival).
  - Thus, the suppression of headphones would not improve the show.
If general dispersion increases, this is due to liberty given to non dangerous riders - for their general classification - during non dangerous stages for their general classification.
Breakaway’s case

- Breakaway
  - When a group of riders breaks away from the front of the bunch
  - Flat stages

- For both periods:
  - Same victory rate (44%)
  - More participants (+2.5)
  - Higher gap with the bunch

- There is a better management of the effort… for the bunch
Conclusion

- The management of the effort of the leader’s teammates is more effective.
- In other words, we can analyze this perspective as a rationality improvement (Simon)
Information systems and area of rationality

Limits related on competences, the practices

Limits related on the values, the objectives

Limits related on knowledge, information
Conclusion

- We can understand these results through the structurationist point of view.

- It is not the technological determinism in the use of information technology that shapes an emergent use of technology but the interaction between technology and organizational actors.
Limits

- Other effects
- Complexity of Information Systems
- Need of a qualitative study