20241128_Business_Intelligence_WIN6

Villalba-Diez, J., Ordieres-Meré, J., Chudzick, H., Lopez-Rojo, P. (2015). NEMAWASHI: Attaining Value Stream alignment within Complex Organizational Networks. Procedia CIRP, 37, 134--139. https://doi.org/10.1016/j.procir.2015.08.021

„Nemawashi". To prepare the ground.

← ORGANIZATION

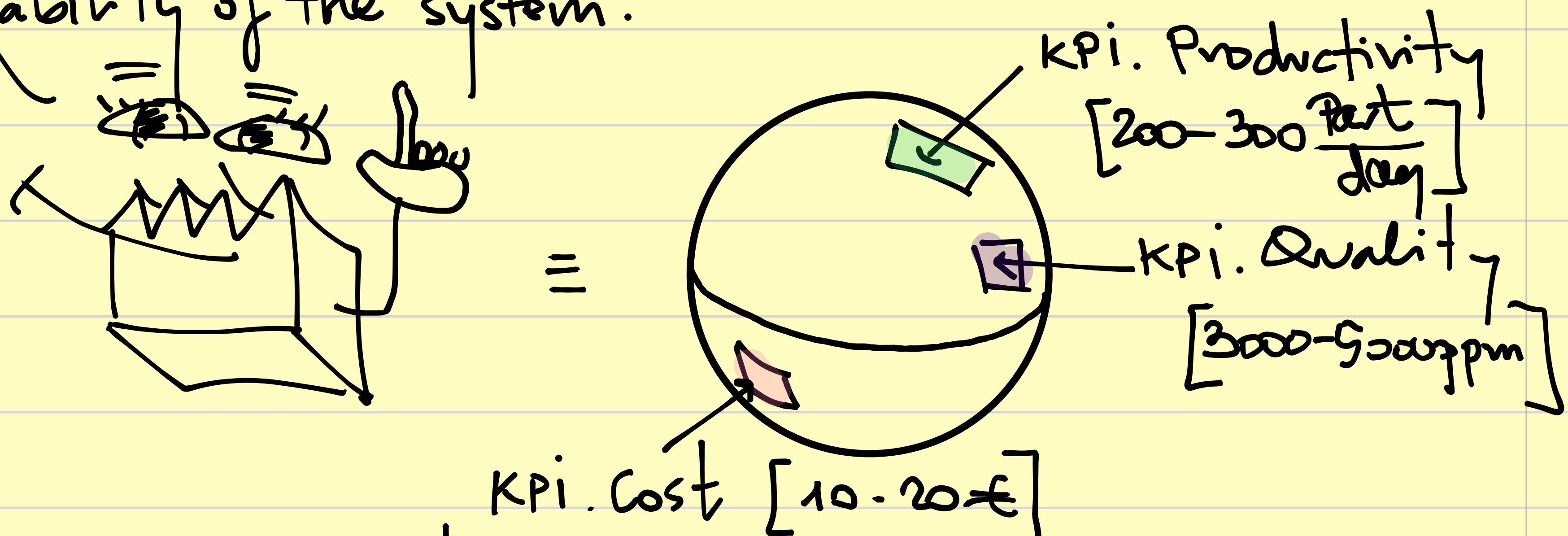
← PREPARE THE GROUND. Management task

with this method we describe ORGANIZATIONAL DYNAMICS. We do so by transforming the information contained in the KPIs from the management system.

hypothesis. There is a list of KPIs given with values at different time points. In other words, we have access to the management system

$KPI_i = KPI_i(t) \quad i = 1, 2, \dots, n$.

Remember that each KPI describes only one part of the variability of the system.



* Principal Component Analysis *

. We measure variability with VARIANCE of the KPI. $VAR = \frac{\sum (x_i - \bar{x})^2}{n}$; $\sigma = \sqrt{VAR}$

The intrinsic meaning of VARIANCE is to be the square of the distance between the points and the mean value. For this reason, if we have many KPIs, some on the 1000s, some on the 100s, some on the 10s, ..., we cannot directly compare them without previous normalization.

Example. A KPI system of a factory is 3 dimensional and has following data.

	Quality [Q] (ppm)	Delivery Rate [DR] (%)	Cost [C] (€/unit)
CW1	3300	91	17
CW2	2700	93	18
CW3	1800	89	16
CW4	1500	92	15
CW5	1300	95	16

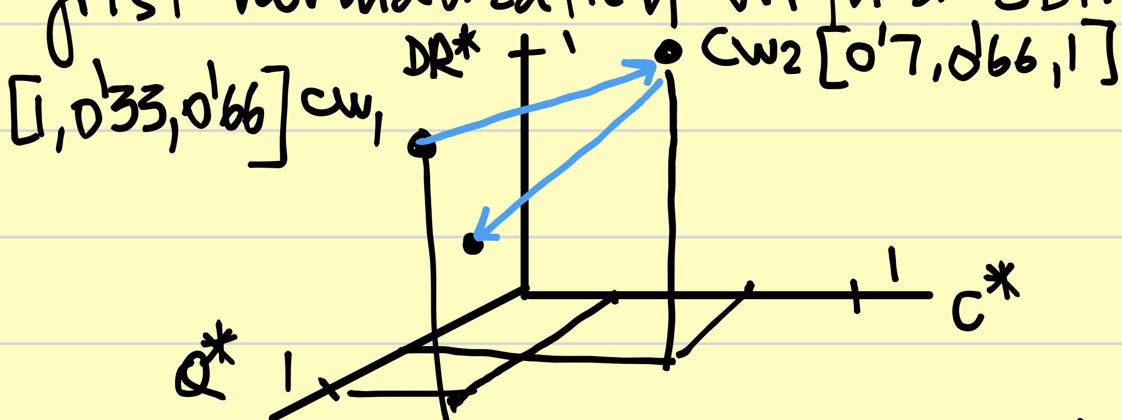
1.Step. Normalize on time axis so that KPIs are comparable.

Normalize 1. $x_i^* = \frac{x_i - \bar{x}}{\sigma_x}$

$\boxed{\text{Normalize 2. } x_i^* = \frac{x_i - x_{min}}{x_{max} - x_{min}}}$

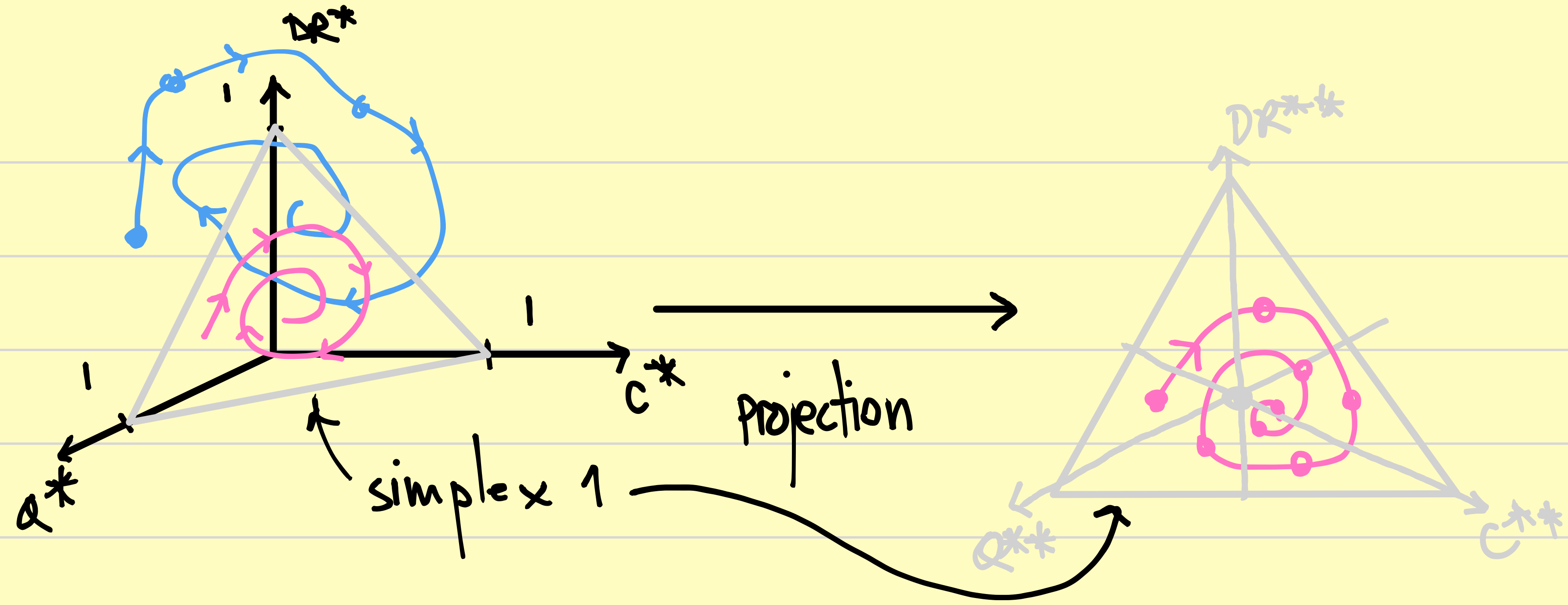
	[Q*]	[DR*]	[C*]
CW1	$\frac{3300-1300}{3300-1300}=1$	$\frac{91-89}{95-89}=0'33$	$\frac{17-15}{18-15}=0'66$
CW2	$\frac{2700-1300}{3300-1300}=0'7$	$\frac{93-89}{95-89}=0'66$	$\frac{18-15}{18-15}=1$
CW3	$\frac{1800-1300}{3300-1300}=0'25$	$\frac{89-89}{95-89}=0$	$\frac{16-15}{18-15}=0'33$
CW4	$\frac{1500-1300}{3300-1300}=0'1$	$\frac{92-89}{95-89}=0'5$	$\frac{15-15}{18-15}=0$
CW5	$\frac{1300-1300}{3300-1300}=0$	$\frac{95-89}{95-89}=1$	$\frac{16-15}{18-15}=0'33$

Step 2. graphically represent the dynamics of the system, and we could do it already with the first normalization with a 3Dimensional plot:



This 3D Representation is not intuitive and is difficult to derive a business conclusion from it.

We project the curve from 3D to the "simplex 1" in 2D.



All the points in the simplex 1 have coordinates that add up to 1 : the sum of their values add up 1.

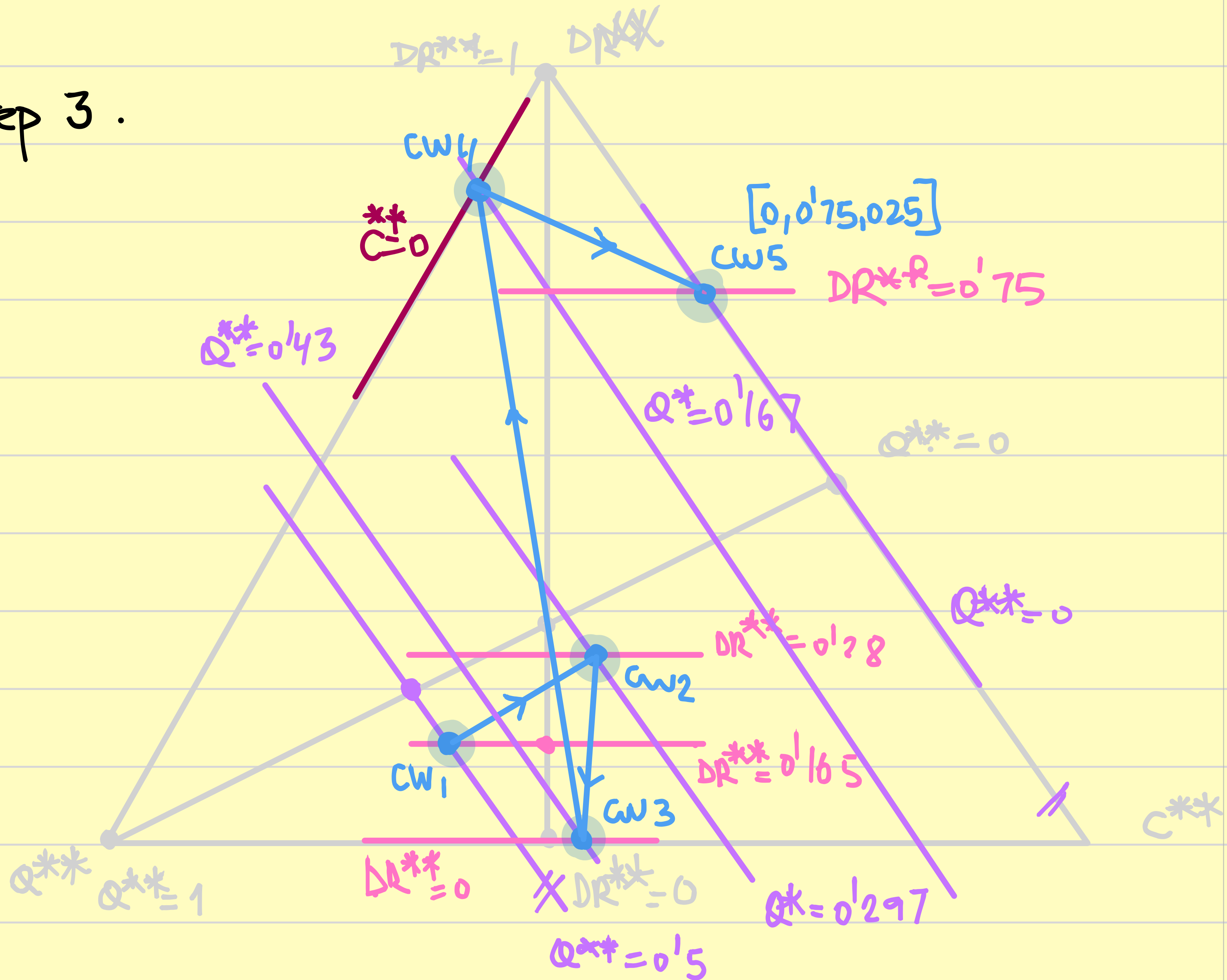
As a result, what we need to do is normalize the values of each time stamp so that they add up 1.

	Q^{**}	DR^{**}	C^{**}
CW_1 (0)	$\frac{1}{1+0'33+0'66}=0'5$	$\frac{0'33}{1+0'33+0'66}=0'165$	$\frac{0'66}{1+0'33+0'66}=0'33$
CW2	$\frac{0'7}{0'7+0'66+1}=0'297$	$\frac{0'66}{0'7+0'66+1}=0'28$	$\frac{1}{0'7+0'66+1}=0'42$
CW_3	$\frac{0'25}{0'25+0+0'33}=0'43$	0	$\frac{0'33}{0'25+0+0'33}=0'57$
CW4	$\frac{0'1}{0'1+0'5+0}=0'167$	$\frac{0'5}{0'1+0'5+0}=0'833$	0
CW5	0	$\frac{1}{0+1+0'33}=0'75$	$\frac{0'33}{0+1+0'33}=0'25$

(c)

$$3,\ 7,\ 6 \longrightarrow \boxed{\frac{3}{3+7+6}+\frac{7}{3+7+6}+\frac{6}{3+7+6}=\frac{3+7+6}{3+7+6}=1}$$

Step 3.



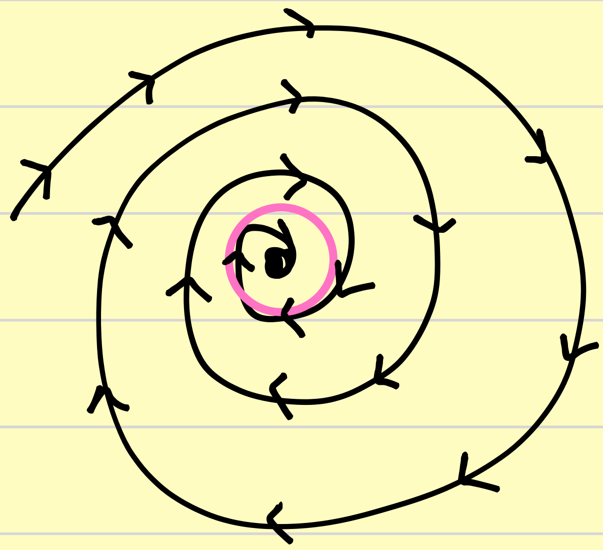
Step 4.

The system is in Alignment on a timepoint t_j if the distance between $|t_{j-2}-t_{j-1}|$ is bigger than the distance between $|t_{j-1}-t_j|$.

Distance $|CW_1-CW_2| < |CW_2-CW_3| \rightarrow$ The distances increase so we have no alignment in the system in CW_3.

$|CW_2-CW_3| < |CW_3-CW_4| \rightarrow$ No Alignment in CW_4

$|CW_3-CW_4| > |CW_4-CW_5| \rightarrow$ Alignment in CW_5.



· If our system remains within the limits of a circle of radius $\varepsilon \to 0$, then our system is under control. Good for business!

FAZIT.