HOW TO CHOOSE THE BEST COMPLIANT BIDDER IN THE CONTEXT OF WEIGHTED ASSESSMENTS?

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Ville de Lévis

Presentation plan

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
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- Introduction and contextual setting
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- Presentation of the City of Lévis
- What are we facing?
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  - The difficulties of the qualitative assessment
  - Basic example
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  - Typical bid assessment structures
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Presentation of MELIORE

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MELIORE provides quantitative advice services (Operational research, Decision-making support, Artificial intelligence…)

- We propose an array of rational methods and techniques geared towards the best way to operate.
- We propose rational models in order to analyze and master complex situations.

- GOAL: To enable decision-makers to understand, assess and make the most efficient choices.

Presentation of MELIORE

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- Opportunities to apply the operational research in the municipal world:
    - Call for tenders weighting grid,
    - Investment project selection (repairing which road segment?),
    - Redesign of the collection sectors and schedules,
    - Infrastructure location,
    - Optimal route for collection or snow removal,
    - Optimal assignment of inspectors.

Presentation of the City of Lévis

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- 7th largest city in Quebec with a population of 145,454 citizens;
- Growth of 8,000 to 9,000 people every 5 years;
- An area of 444 km², with 10% urbanized, 48% from agriculture, 36% under forest cover, whereas wetlands account for 6% of the land;
- Close to 1,000 km of streets and roads, and 50 km of riverside;
- Annual budget of $258 million;
- Annual gross investments of $100 million in fixed assets.

Presentation of the City of Lévis

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- In terms of calls for tenders at the Procurement Directorate, there are:
    - 2 managers;
    - 5 purchasers;
    - 3 procurement advisors:
        - Contractual management;
        - Procurement and business practices;
        - Law.
    - More than 275 calls for tenders annually, with a hundred being on invitation and 175 public, including 45 calls for tender with a qualitative assessment.
    - Vincent Vu has more than 350 selection committees to his credit as a secretary or committee member.

Relevance of the qualitative assessment

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- When the lowest compliant price rule doesn't work;
- Mandatory for professional services;
    - There are two possible systems:

a) 1 envelope: - Flexibility
- Unexploited assessment methods

b) 2 envelopes: - Rigid framework;
- Less control on price weighting;
- Assessment methods in hindsight.

Relevance of weighted calls for tenders

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- Issues and complexities:
    - The main issue of a call for tenders is defining the need and writing it;
    - Moreover, assessing the resulting tenders is a challenge in itself;
    - So, some criteria are more complex and hard to write in a call for tenders quote, such as “ergonomics”;
        - A less friendly, but efficient, solution in terms of data integration could still be convenient.

The problem is to base the decisions and directions on well-documented and non-arbitrary components.

The definition of the criteria and their weighting vs. the choice of the right price formula.

The difficulties of the qualitative assessment

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- Other than the definition of the need and the qualification of the result to reach specific to both systems:
    - Two-envelope system:
        - Double assessment possible;
        - Point allocation scale;
        - Price weighing (formula with a 0-50 ratio);
        - Weighting of the criteria.
    - One-envelope system:
        - Price weighting (choice of formula);
        - Price formula;
        - Weighting of the criteria;
        - Tolerance to price growth depending on the suggested quality levels.

Basic example
Typical weighting grid

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- Below is a simple array of criteria as part of the one-envelope system; the purchase of a vehicle:

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score

Basic example
Typical weighting grid

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- Below is a weighting given to these criteria

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Weight of the criteria	20%	30%	20%		30%	

Basic example
Typical weighting grid

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- Below are the individual grades received per criterion:

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Kia	60	50	50	35,000		
Acura	70	75	75	55,000		
Bentley	100	100	100	375,000		
Weight of the criteria	20%	30%	20%		30%	

Basic example
Typical weighting grid

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- Below is a formula for the price grade related to the price

$$grade = (1 - (price - \min_price) / \min_price) * 100$$

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Kia	60	50	50	35,000	100	
Acura	70	75	75	55,000	42.9	
Bentley	100	100	100	375,000	0	
Weight of the criteria	20%	30%	20%		30%	

Basic example
Typical weighting grid

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- Below is a formula for the price grade related to the price

$$price_grade = (1 - (price - \min_price / \min_price)) * 100$$

- For the Kia, since it has the lowest price, it gets 100%,
- For the Acura, $price\downarrow grade = (1 - (375\,000 - 35\,000) / 35\,000) * 100 = 42.9$
- For the Bentley, $price\downarrow grade = (1 - (375\,000 - 35\,000) / 35\,000) * 100 = 0$

Basic example
Typical weighting grid

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- Calculation of individual scores
    - In this example, the score is the weighted average, i is the vehicle ratio and j, the criterion ratio :

$$Score_i = \sum_{j=1}^{4} W_{i,j} N_{i,j}$$

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score	Rank
Kia	60	50	50	35,000	100	67	2
Acura	70	75	75	55,000	42.9	64.4	3
Bentley	100	100	100	375,000	0	70	1
Weight of the criteria	20%	30%	20%		30%		

Questions we will try to answer

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- When should we use weighted calls for tenders?
- Does the compliant lowest price rule still meet the need?
- How do we choose the selection criteria?
- How to weight the criteria?
- What alternative solutions are available to assess the qualitative criteria?
- Why does the best intuitive choice does not match with the grid result?
- What are the difficulties and solutions linked to using weighting grids?

Problems with typical structures

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The following elements will be analyzed depending on both qualitative assessment systems:

A) Two-envelope system;

B) One-envelope system.

1. The choice of criteria (A and B);
2. The average problem (B);
3. The weight problem (A and B);
4. The grade problem (B)
    1. The qualitative grade problem
    2. The grade problem related to the price

THE CHOICE OF CRITERIA

Problems with typical structures

The choice of criteria

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Observations

- The choice of criteria is often an exercise taken for granted and not very creative;
- The tendency is to use common and known criteria;
- The law does not state any criterion other than the price in a one-envelope system, except that the criteria be directly related to the market;
- Are there methods to validate our criteria?

Problems with typical structures

The choice of criteria

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- Criteria uncorrelated or not very correlated with the need for quality

Vehicle	Interior space	Safety	Prestige	Price	Qualitative grade

- Criteria correlated with each other

Vehicle	Luxurious	Safety	Comfort on the road	Price	Qualitative grade

Problems with typical structures

The choice of criteria — solutions

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- Correlation study
  - Based on past results, it serves as a basis to other methods and is often sufficient.
- The main component analysis (Karhunen–Loève transformation)
  - Is a method from the multivariate statistical family, that transforms correlated variables into new variables that are uncorrelated with each other. These new variables are called “main components”. They reduce the number of variables and make the information less redundant.
- GAIA method
  - Is a vectorial geometry method that enables the decision-maker to visualize the main characteristics of a decision problem. The goal is to easily identify the conflicts or synergies between the criteria and to highlight the remarkable performances.
- Delphi method
  - Structured pooling of expert opinions

Problems with typical structures

The choice of criteria — Correlation study of a real project (in hindsight)

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- Call for tenders: Case #1: Professional services to develop a sewer master plan

- Criteria used for this project:

1.	Experience of the service provider	20%
2.	Organization of the project	20%
3.	Experience of the project leader	20%
4.	Experience and relevance of the project team	30%
5.	Capacity of the succession	10%

PARTIE 1

Évaluation de chaque offre de services			Prestataire de services A		Prestataire de services B		Prestataire de services C		Prestataire de services D		Prestataire de services E	
CRITÈRES (minimum de 4)		Nombre maximal de points attribués (N=1 à 30)	Cote 0 à 100 %	Pointage	Cote 0 à 100%	Pointage	Cote 0 à 100 %	Pointage	Cote 0 à 100 %	Pointage	Cote 0 à 100 %	Pointage
1) Expérience du prestataire de services		20										
2) Organisation du projet		20										
3) Expérience du chargé de projet		20										
4) Expérience et pertinence de l'équipe proposée		30										
5) Capacité de relève		10										
POINTAGE TOTAL INTÉRIMAIRE :		100		/100		/100		/100		/100		/100

Les enveloppes de prix des offres dont le pointage intérimaire est de moins de 70 sont retournées au prestataire de services,

SANS AVOIR ÉTÉ OUVERTES

PARTIE 2

ÉTABLISSEMENT DU POINTAGE FINAL	Prestataire de services A	Prestataire de services B	Prestataire de services C	Prestataire de services D	Prestataire de services E
Prix soumis (Uniquement pour les offres dont le pointage intérimaire est d'au moins 70)					
Établissement du pointage final : $\frac{\text{(Pointage intérimaire + 50) x 10 000)}}{\text{Prix}}$					
Rang de chaque soumissionnaire					

Problems with typical structures

The choice of criteria — Results of the committee

	1. Experience of the service provider	2. Organization of the project	3. Experience of the project leader	4. Experience and relevance of the project team	5. Capacity of the succession	Qualitative score (original)
Bidder 1	70	65	60	60	70	64
Bidder 2	75	80	80	75	70	76.5
Bidder 3	60	60	65	60	60	61
Bidder 4	70	70	70	75	70	71.5
Bidder 5	70	75	70	60	70	68
Bidder 6	85	90	90	80	70	84
Weighting	20%	20%	20%	30%	10%	

Problems with typical structures
The choice of criteria — correlation

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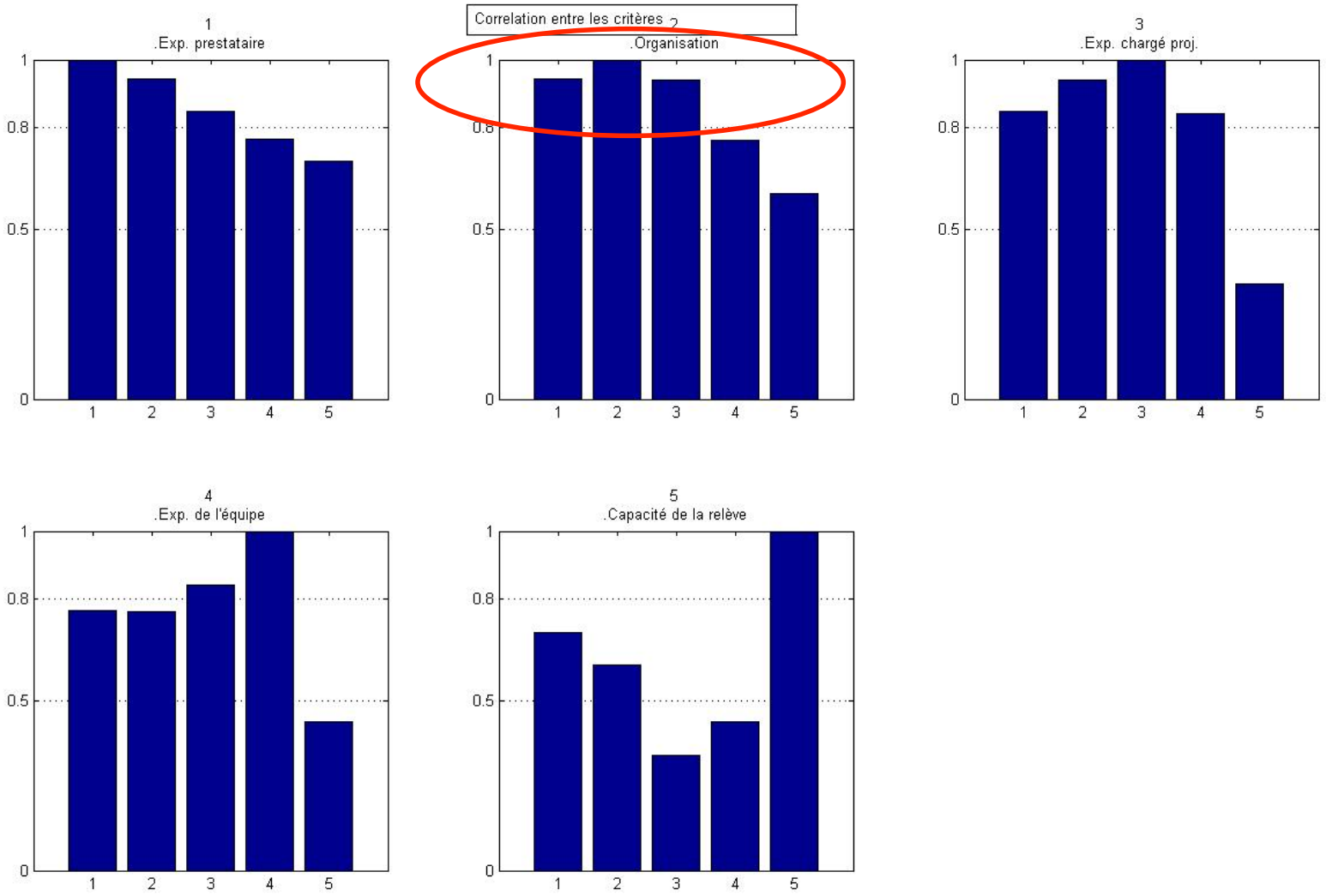
$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2} * \sqrt{n(\sum y^2) - (\sum y)^2}}$$

- **Interpretation of r:**
    - Always varies from -1 to 1
    - R=1 only if all the dots go exactly through the straight line and -1 if the dots go through a negative slope straight line.
    - If X and Y are independent, r=0.
    - R=0 only if b=0.

Problems with typical structures

The choice of criteria— Case #1



Problems with typical structures

The choice of criteria — Case #1

	1. Experience of the service provider	2. Organization of the project	3. Experience of the project leader	4. Experience and relevance of the project team	5. Capacity of the succession	Qualitative score (original)	Qualitative score (modified)
Bidder 1	70	65	60	60	70	64	64
Bidder 2	75	80	80	75	70	76.5	77.5
Bidder 3	60	60	65	60	60	61	60
Bidder 4	70	70	70	75	70	71.5	71.5
Bidder 5	70	75	70	60	70	68	70
Bidder 6	85	90	90	80	70	84	85
Weighting	0	60%	0	30%	10%		

Problems with typical structures

The choice of criteria — Case #1

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Observations:

- The 1st, 2nd and 3rd criteria seem to measure the same thing;
- Therefore, it's the equivalent of only 3 criteria, including 1 worth 60% of the points;
- In principle, someone could think the law is not respected;
- Even if it's not the case, this confirms the double-assessment problem.

Problems with typical structures

The choice of criteria — Case #1

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- **Is it pure coincidence ?**
- **Do we have enough data to conclude ?**
- **What is the significant value of r ?**

$$Z = \sqrt{\square}n-2\ r/\sqrt{\square}1-r\uparrow 2$$

- If $|Z|>2,5$ there is 99% of chances that the correlation is not pure coincidence
- In our case, we have Z=6,08, so ~ 1 in 10 billion chance that is pure coincidence
- For Loto-Max it's one in 28 million chance !

Problems with typical structures

The choice of criteria — Good practices

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Conclusion, according to the studies of Ralph Keeney and Howard Raïffa [1976]

- The assessment criteria must have 5 characteristics:
    - Exhaustive – full
    - Operational – practically usable
    - Decomposable – we can assign it a grade
    - Non-redundant – uncorrelated between themselves
    - Minimal – reduced to the lowest number possible

THE AVERAGE

Problems with typical structures

The average – One-envelope system

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- The problem with the weighted average of the criteria is that it can force us to chose a solution that we don't want:

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Kia	60	50	50	35,000	100	67
Acura	70	75	75	55,000	42.9	64.4
Bentley	100	100	100	375,000	0	70
Weight of the criterion	20%	30%	20%		30%	

Problems with typical structures

The average – One-envelope system

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- In a simplified example, we get a counterintuitive choice

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score	Rank
Vehicle1	100	13	100	35,000	100	78.25	1
Vehicle 2	70	70	70	35,001	99.99	77.5	2
Weight of the criterion	25%	25%	25%		25%		

At the same prices, would we be willing to chose the unsafe vehicle?

Problems with typical structures

The average — One-envelope system — Solution

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      1. Minimal grade
      2. Multiplication
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1) Put a passing grade on a criterion, 50% or 60% for example.
   - In this case, vehicle #1 would be eliminated from the possible options

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
~~Vehicle 1~~	~~100~~	~~13~~	~~100~~	~~35,000~~	~~100~~	~~67~~
Vehicle 2	70	70	70	35,001	99.99	64.4
Weight of the criterion	25%	25%	25%		25%	

Problems with typical structures

The average – One-envelope system

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Moreover, this example shows that even with a passing grade of 60%, the weighting has no effect.

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Vehicle 1	83	83	83	35,000	100	87.2567
Vehicle 2	60	100	90	35,001	99.99	87.5
Weight of the criterion	25%	25%	25%		25%	

Problems with typical structures

The average — One-envelope system — Solution

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2) Use the product of the grades rather than the average

60*100*90*99.99 = 53,994,600

With the multiplication, the result is much closer than the intuition

Example: Simplified multiplicative method

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Vehicle 1	83	83	83	35,000	100	57,178,700
Vehicle 2	60	100	90	35,001	99.99	53,994,600
Weight of the criterion	1	1	1		1	

Problems with typical structures

The average — One-envelope system — Solution

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- The basic example with the simplified multiplicative method, the weights of the criteria are equal.

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score	Rank
Kia	60	50	50	35,000	100	15,000,000	2
Acura	70	75	75	55,000	42.9	16,891,875	1
Bentley	100	100	100	375,000	0	0	3
Weight of the criterion	20	30	20		30		

THE PROBLEM OF THE CRITERIA WEIGHTS

Problems with typical structures

The weight — One-envelope system — Case #2

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- Call for tenders, case #2: Provision of recreational play structures

Criteria used for this project:	Weighting
Design and layout of the play equipment	20%
Play value of the equipment	15%
Child development	10%
Quality of the products	10%
Quality of the file presentation	10%
Service plans, warranties and maintenance	10%
Price (using the formula grade=min_price/price)*100	25%
Total	100%

Problems with typical structures
The weight — One-envelope system — Case #2

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Évaluation de chaque offre		Soumissionnaire A		Soumissionnaire B		Soumissionnaire C		Soumissionnaire D	
CRITÈRES AUTRES QUE LE PRIX	Nombre maximal de points attribués (N))	Cote (C) 0 à 100 %	Pointage (N*C)	Cote (C) 0 à 100 %	Cote (C) 0 à 100 %	Cote (C) 0 à 100 %	Pointage (N*C)	Cote (C) 0 à 100 %	Pointage (N*C)
1.1 Design et aménagement 1.2 Intérêts ludiques des équipements 1.3 Développement de l'enfant 1.4 Qualité du produit	20 15 10 10								
2. Qualité de présentation du dossier	10								
3. Plans de service, garanties et entretien	10								
SOUS-TOTAL	75								
L'offre présentant le prix le plus bas obtient le maximum des points prévus pour le critère relatif au prix. Le nombre de points attribués aux autres offres de services est calculé selon la formule suivante : (Prix soumis le plus bas divisé par le prix d'une offre conforme) multiplié par le nombre maximal de points pour le critère du prix									

ÉTABLISSEMENT DU POINTAGE TOTAL		Soumissionnaire A	Soumissionnaire B	Soumissionnaire C	Soumissionnaire D
Prix soumis					
4. Pointage pour le critère « prix », calculé selon la formule ci-dessus mentionnée	25				
POINTAGE TOTAL DE LA SOUMISSION: (sous-total + pointage du critère « prix »)		/100	/100	/100	/100
Rang de chaque soumissionnaire selon le pointage					

Problems with typical structures

The weight — One-envelope system — Case #2

	Design and layout	Play value	Child development	Quality of the products	Quality of the presentation	Service plans, warranties and maintenance	Price ($)	Grade related to the price	Score	Rank
Bidder 1	80	75	70	65	70	75	40,790	100	80.25	1
Bidder 2	80	80	75	80	75	70	47,646	85.6	79.40	2
Bidder 3	65	70	70	65	65	70	94,981	42.92	61.23	3
Weighting	20%	15%	10%	10%	10%	10%		25%		

Problems with typical structures

The weight — One-envelope system — Case #2

	Design and layout	Play value	Child development	Quality of the products	Quality of the presentation	Service plans, warranties and maintenance	Price ($)	Grade related to the price	Score	Rank
Bidder 1	80	75	70	65	70	75	40,790	100	78.75	2
Bidder 2	80	80	75	80	75	70	47,646	85.6	79.40	1
Bidder 3	65	70	70	65	65	70	94,981	42.92	61.23	3
Weighting	~~20%~~ 10%	15%	10%	~~10%~~ 20%	10%	10%		25%		

Problems with typical structures

The weight — One-envelope system

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
5. Feedback on learning

- Therefore, the weighting has a significant effect on the result of the call for tenders.

- According to the studies of Hervé Thiriez and Daniel Houri [1975]:
    - 8 out of 10 decision-makers gave different weights, in the same practical case, one hour apart!

Problems with typical structures

The weight — In the two systems — Solutions

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
5. Feedback on learning

- Delphi Method (in principle)
    - Structured pooling of expert opinions
- Comparison Method (in principle and in hindsight)
    - Compare two by two each of the criteria in the matrix format to prioritize the criteria
- Entropy Method (in hindsight)
    - The entropy represents the relative intensity of the importance of the attributes as a representation of the information level transmitted to the decision-maker.
- Sensitivity Test (in hindsight)
    - The sensitivity test helps determine a result's sensitivity to the variation of a parameter.

Problems with typical structures

The weight — Solutions: Two by two comparisons

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
        1. Two by two comparison
    4. The grade
5. Feedback on learning

If we replace the usual weighting and grade assignment scale with the two by two comparison method:

1) Qualify each of the criteria with each other according to the following grid:
    1. No preference
    2. Moderately preferred
    3. Strongly preferred
    4. Very strongly preferred
    5. Extremely preferred

    For the antonyms, we use 1/3, 1/5, …
2) Build your matrix [A]

Problems with typical structures

The weight — In the two systems — Solutions

1. Introduction and contextual setting
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4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
        1. Two by two comparison
    4. The grade
5. Feedback on learning

- Construction of the matrix [A]

Criterion **A** is “strongly preferred” to criterion **B,** including cell **A-B =3** and cell **B-A= 1/3** by reciprocity

[A]=

	A	B	C	D
A	1	3		
B	1/3	1		
C			1	
D				1

Problems with typical structures

The weight — In the two systems — Solutions

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
   1. The choice of criteria
   2. The average
   3. The weight
      1. Two by two comparison
   4. The grade
5. Feedback on learning

- Calculation of the proper values and the eigenvectors

$AW=\lambda W \Leftrightarrow (A-\lambda I)W=0$, where $I=\begin{bmatrix}1&0&0\\0&\ddots&0\\0&0&1\end{bmatrix}$ and λ the proper value of A and W its corresponding eigenvector. Since there are as many proper values as criteria, we choose λMax and its eigenvector.

The solution is given by :

$\det(A-\lambda I)=0 \Leftrightarrow |A-\lambda I|=0$

Problems with typical structures

The weight — In the two systems — Solutions

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
        1. Two by two comparison
    4. The grade
5. Feedback on learning

- One of the conditions for using the method is that we must assume that the assessment are transitive. However, we accept some distorsion.
    - If A>B and B>C, so A>C

- We measure the distorsion to the CI transitivity

$$CI = \lambda\downarrow max - n/n - 1$$

$$CI\ must\ respect\ 0 \geq CI \geq 0{,}1$$

Problems with typical structures

The weight — One-envelope system — Case #2 results

	Design and layout	Play value	Child development	Quality of the products	Quality of the presentation	Service plans, warranties and maintenance	Price ($)	Grade related to the price	Score	Rank
Bidder 1	80	75	70	65	70	75	40,790	100	84.42	1
Bidder 2	80	80	75	80	75	70	47,646	85.6	77.49	2
Bidder 3	65	70	70	65	65	70	94,981	42.92	57.68	3
Weighting (New) Weighting (Original)	6.28% 20%	9.78% 15%	10.67% 10%	21.12% 10%	3.31% 10%	8.99% 10%		39.8% 25%		

THE GRADE

Problems with typical structures

The grade — One-envelope system

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- What is the best formula to weight the price (in $) on a grade in %?

Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Kia	60	50	50	35,000	100	67
Acura	70	75	75	55,000	42.9	64.4
Bentley	100	100	100	375,000	0	70
Weight of the criterion	20%	30%	20%		30%	

Problems with typical structures

The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- Replacement of the incinerator's continuous smoke tester (FTIR)

- Criteria used for this project:

1. Experience of the supplier	25%
2. Organization of the project	25%
3. Warranties, after-sale services and availability of the parts	10%
4. Price (using the formula grade=min_price/price*100)	40%

Problems with typical structures

The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- The formula to calculate the price-related grade is the following :

$$grade = \min_price / price * 100$$

	Experience of the supplier	Organization of the project	Warranties, after-sale services and availability of the parts	Price ($)	Grade related to the price	Score	Rank
Bidder 1	70	70	80	898,596	84.5	76.8	1
Bidder 2	30	50	30	759,363	100	63	2
Weighting	25%	25%	10%		40%		

Problems with typical structures
The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

Évaluation de chaque offre		Soumissionnaire A		Soumissionnaire B		Soumissionnaire C		Soumissionnaire D		Soumissionnaire E	
CRITÈRES AUTRES QUE LE PRIX	Nombre maximal de points attribués (N))	Cote 0 à 100 %	Pointage	Cote 0 à 100%	Pointage	Cote 0 à 100 %	Pointage	Cote 0 à 100 %	Pointage	Cote 0 à 100 %	Pointage
1. Expérience du fournisseur	25										
2.Organisation du projet	25										
3. Garanties, service après vente et disponibilité des pièces	10										
SOUS-TOTAL	60										
	/60	/60	/60	/60	/60	/60	/60	/60	/60	/60	/60
CRITÈRES DU PRIX *											
Prix soumis											
4. Pointage pour le critère « prix » (max. de 40 points)	40										
	/40	/40	/40	/40	/40	/40	/40	/40	/40	/40	/40
POINTAGE TOTAL DE LA SOUMISSION:	100										
	/100	/100		/100		/100		/100		/100	

*Pour le critère relatif au prix, l'offre présentant le prix le plus bas obtient le maximum des points prévus.

Le nombre de points attribués à chaque soumission pour le critère relatif au prix est calculé selon la formule suivante :

$$\frac{\text{(Prix soumis le plus bas X « 40 points »)}}{\text{Prix d'une offre conforme}}$$

Problems with typical structures

The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
   1. The choice of criteria
   2. The average
   3. The weight
   4. The grade
      1. Grade related to the price
      2. Grade of the qualitative criteria
5. Feedback on learning

- Let's imagine we open the envelopes and have the following surprise:

	Experience of the supplier	Organization of the project	Warranties, after-sale services	Price ($)	Grade related to the price	Score	Rank
Bidder 1	70	70	80	1,400,000	54.24	64	1
Bidder 2	30	50	30	759,363	100	63	2
Weighting	25%	25%	10%		40%		

Problems with typical structures

The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- Where does this distortion come from?
- The problem comes from three places:
    A. The weighting of the price is lower than 50%
    B. The average is used to calculate the final grade rather than the multiplicative method
    C. The price grading method does not penalize the prices markedly too high

- Using one or several of the above-mentioned protections would have made it possible to avoid this result.

Problems with typical structures

The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
            A. Weighting
            C. Formula
        2. Grade of the qualitative criteria
5. Feedback on learning

A) Using the highest-price weighting: assign 60% to the price and proportionally adjust the other criteria

	Experience of the supplier	Organization of the project	Warranties, after-sale services	Price ($)	Grade related to the price	Score	Rank
Bidder 1	70	70	80	1,400,000	54.24	60.9	2
Bidder 2	30	50	30	759,363	100	75.6	1
Weighting	18%	18%	4%		60%		

Problems with typical structures

The grade — One-envelope system — Case #3

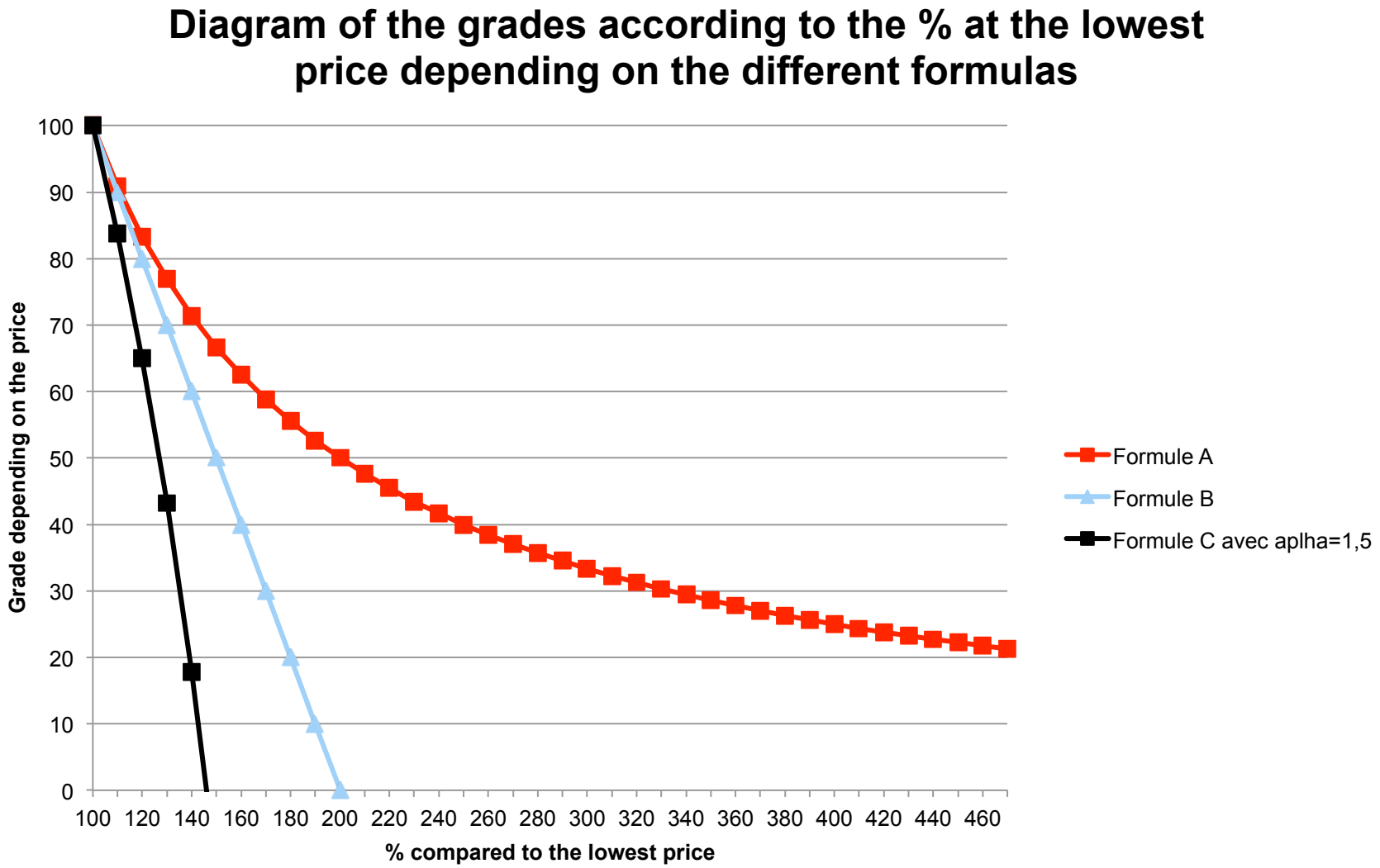
1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
   1. The choice of criteria
   2. The average
   3. The weight
   4. The grade
      1. Grade related to the price
         A. Weighting
         C. Formula
      2. Grade of the qualitative criteria
5. Feedback on learning

C) Using a price allocation method penalizing the extreme prices more harshly

- Different formulations are possible, depending on the desired result :
  a) $grade = \min_price / price * 100$
  b) $grade = (1 - (price - \min_price) / \min_price) * 100$
  c) $grade = (2 - \exp((price - \min_price) / \min_price * \alpha)) * 100$ *with* $0{,}75 \leq \alpha \leq 10$
  d) $grade = a * ((price) / \min_price)\uparrow 2 + b * (price) / \min_price + c$
- We have to be aware of biases that are caused by using either the formulas.

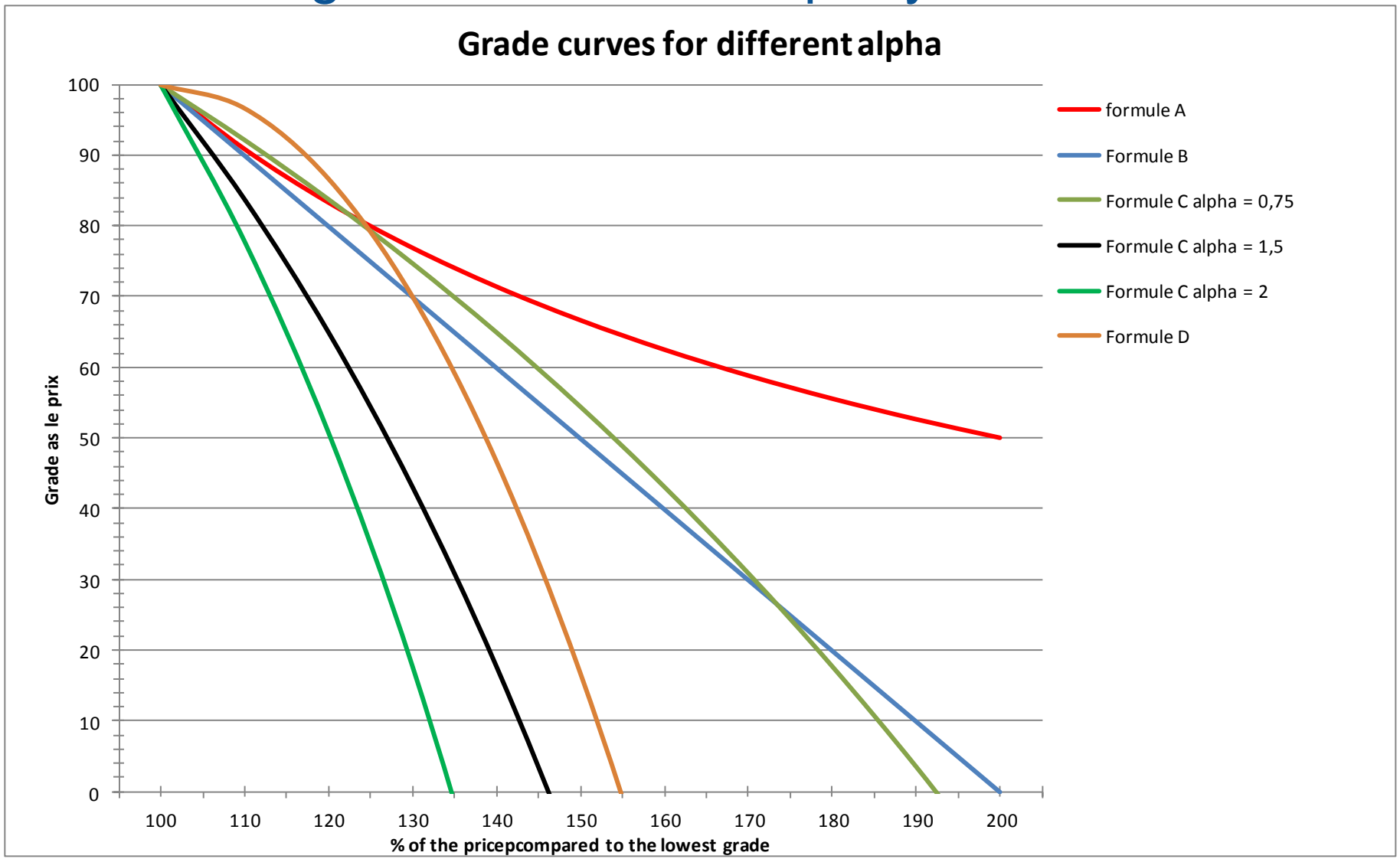
Problems with typical structures

The grade — One-envelope system



Problems with typical structures

The grade — One-envelope system



Problems with typical structures

The grade — One-envelope system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
            A. Weighting
            C. Formula
        2. Grade of the qualitative criteria
5. Feedback on learning

C) Calculating grades according to the different formulas:

	Price ($)	Grade related to the price formula A	Score formula A	Grade related to the price formula B	Score formula B	Grade related to the price formula C with alpha = 1.5	Score formula C with alpha = 1.5
Bidder 1	1,400,000	54.24	64	15.63	49.25	0	43
Bidder 2	759,363	100	63	100	63	100	63

Problems with typical structures

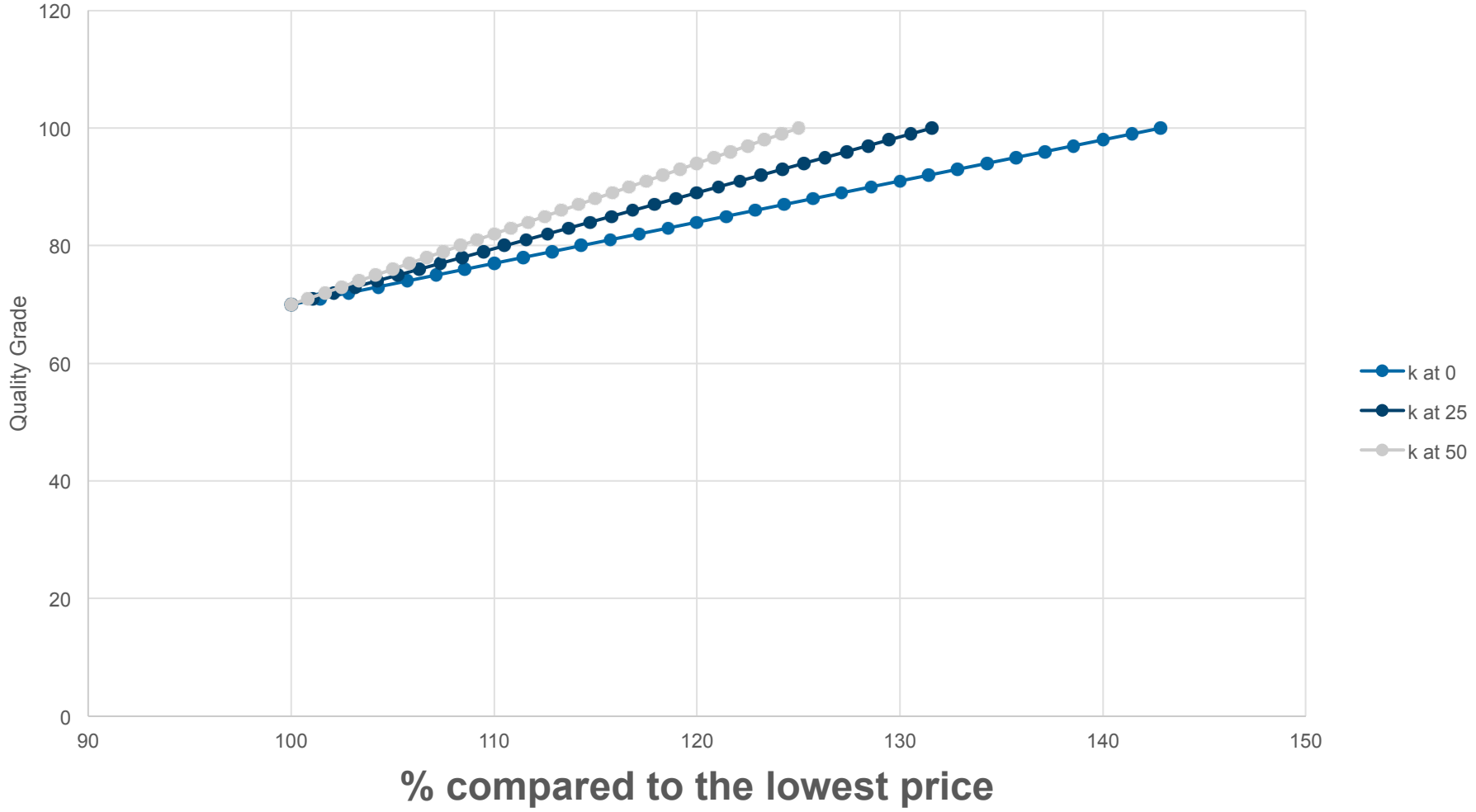
The grade — two-envelopes system — Case #3

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
            A. Weighting
            C. Formula
        2. Grade of the qualitative criteria
5. Feedback on learning

- Different formulations are possible, depending on the desired result :
    a) $grade = (quality \downarrow grade + k) * 10000 / Price \ \ with \ 0 \leq k \leq 50$

Problems with typical structures

The grade — two-envelopes system



Problems with typical structures

The grade — Qualitative aspect

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

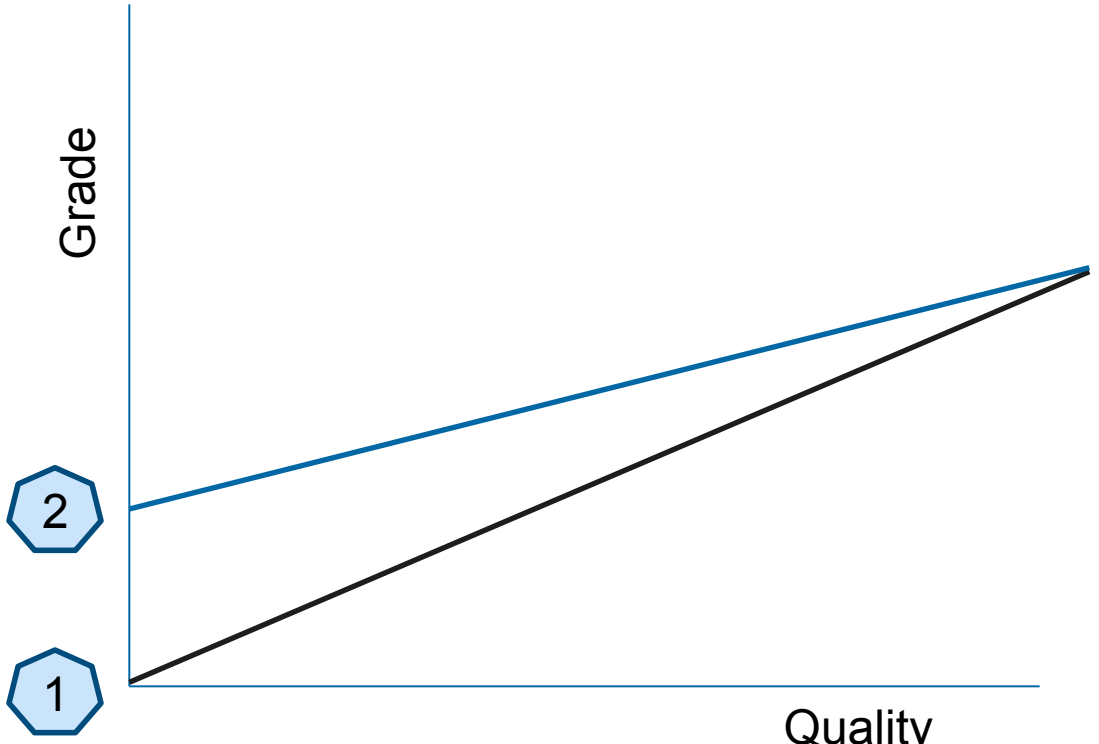
Vehicle	Interior space	Safety	Comfort on the road	Price ($)	Price grade	Score
Kia	60	50	50	35,000	100	15,000,000
Acura	70	75	75	55,000	42.9	16,891,875
Bentley	100	100	100	375,000	0	0
Weight of the criterion	20%	30%	20%		30%	

Problems with typical structures

The grade — Qualitative aspect

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- Each assessor has a different scale!

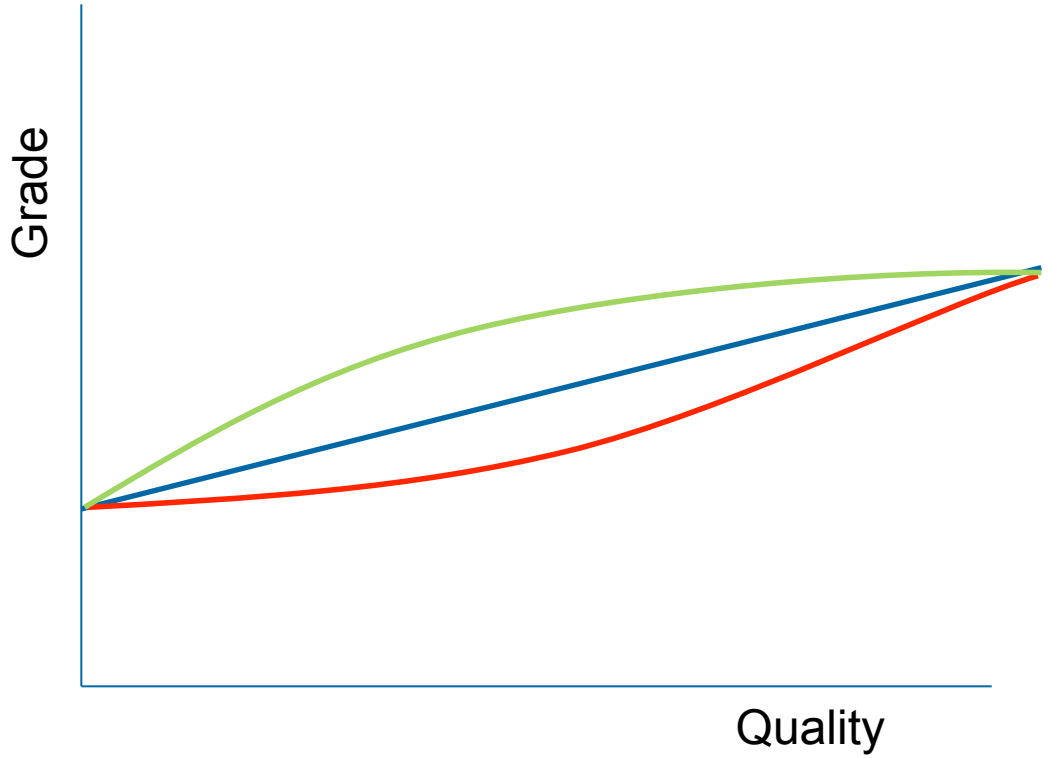


Problems with typical structures

The grade — Qualitative aspect

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- The scales are not all linear

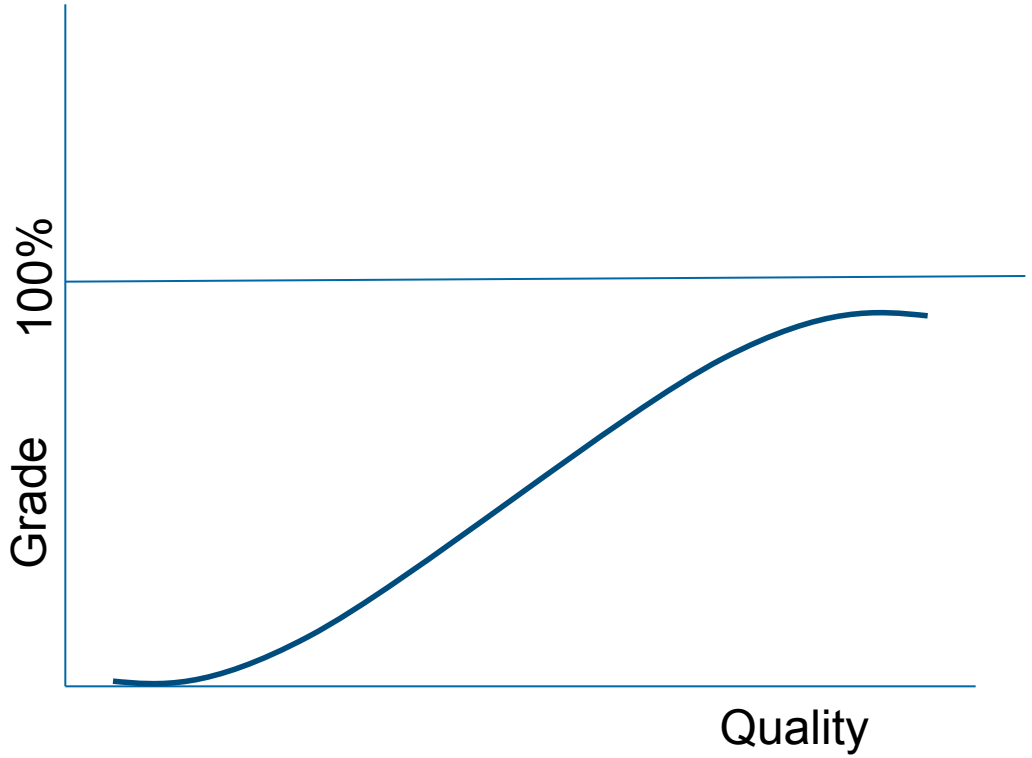


Problems with typical structures

The grade — Qualitative aspect

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
5. Feedback on learning

- The scales are not all linear



Problems with typical structures

The grade — Solutions

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
            1. Two by two
            2. Marginal gain grid
5. Feedback on learning

1) Using the two by two comparison method to compare the bidders between them, one criterion at a time;
2) Developing the grid in terms of marginal gain:
    - Each step forward in the assessment grid represents our desire to pay more for this quality.

Problems with typical structures

The grade — One-envelope system — Case #2

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
            1. Two by two
            2. Marginal gain grid
5. Feedback on learning

1. With the two by two comparison method, we found the following weighting:

Criteria used for this project:	Weighting
Design and layout of the play equipment	6.28%
Play value of the equipment	9.78%
Child development	10.67%
Quality of the products	21.11%
Quality of the file presentation	3.31%
Service plans, warranties and maintenance	8.99%
Price (using the formula grade=price/ min_price*100)	39.85%
Total	100%

Problems with typical structures

The grade — One-envelope system — Case #2 results

- By using the two by two comparison method, we can assess each of the characteristic and obtain their relative score.

	Design and layout	Play value	Child development	Quality of the products	Quality of the presentation	Service plans, warranties and maintenance	Price ($)	Grade related to the price	Score	Rank
Bidder 1	61.75	42.85	63.70	42.85	63.70	33.33	40,790	72.19	57.79	1
Bidder 2	29.69	42.85	25.83	42.85	25.83	33.33	47,646	22.70	30.76	2
Bidder 3	8.56	14.30	10.47	14.30	10.47	33.33	94,981	5.10	11.45	3
Weighting	6.28	9.78	10.67	21.12	3.31	8.99		39.85		

Problems with typical structures

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
    1. The choice of criteria
    2. The average
    3. The weight
    4. The grade
        1. Grade related to the price
        2. Grade of the qualitative criteria
            1. Two by two
            2. Marginal gain grid
5. Feedback on learning

Appel d'offres no 2016-55-03 SERVICES PROFESSIONNELS EN INGÉNIERIE POUR LA RÉFECTION DES RUES SAINT-LAURENT ET LOUIS-FRÉCHETTE	**Soumissionnaires** (Inscrire le nom de chaque soumisionnaire vis-à-vis le pourcentage qui lui est attribué) **Seuls les % mentionnés à cette échelle peuvent être attribués lors de l'analyse individuelle**	**Cote (en %)**	**681 600 $** estimé avant taxes
Critère no: 1 **Titre: Compréhension du mandat et méthodologie** **25 points**			
Dépasse **nettement** le niveau de qualité SATISFAISANT et pourrait représenter un coût additionnel jusqu'à (Wi*0.25 %*E) par rapport à l'estimation établie par la municipalité		**91 à 100**	34 149 $ à 42 600 $
Dépasse **beaucoup** le niveau de qualité SATISFAISANT et pourrait représenter un coût additionnel jusqu'à (Wi*0.167 %*E) par rapport à l'estimation établie par la municipalité		**81 à 90**	17 034 $ à 28 457 $
Dépasse **peu** le niveau de qualité SATISFAISANT et pourrait représenter un coût additionnel jusqu'à (Wi*0.0833 %*E) par rapport à l'estimation établie par la municipalité		**71 à 80**	0 $ à 14 194 $
SATISFAISANT (répond en tous points aux exigences minimales indiquées au devis d'appel d'offres pour ce critère)		**70**	- $
N'atteint pas le niveau de qualité SATISFAISANT, mais celui-ci **peut être compensé** par les résultats des autres critères		**61 à 69**	- $
N'atteint pas le niveau de qualité SATISFAISANT, mais celui-ci **peut difficilement être compensé** par les résultats des autres critères		**51 à 60**	- $
N'atteint pas le niveau de qualité SATISFAISANT, mais celui-ci **ne peut être compensé** par les résultats des autres critères		**41 à 50**	- $

Learnings and benefits

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
5. Feedback on learning
    1. Observations
    2. Available tools
    3. Testimonies
    4. Benefits

- Observations:
  - The lowest compliant price does not meet the needs anymore
    - Suppliers: Only give a price, without regard to results,
    - Customers: Get a product or a service equal to the price paid, or less in some cases.
  - Everybody is losing, the citizen first.
  - In the great majority of cases, the assessment work of the selection committees is futile considering the weight of the price. Hence, the loss of interest to do the exercise well, or to do it at all.
  - All seem resigned to pay a small price for mediocre results.

Learnings and benefits

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
5. Feedback on learning
    1. Observations
    2. Available tools
    3. Testimonies
    4. Benefits

- NOT US!!! We are convinced that there is light at the end of the tunnel!
- However:
    - We have to get off the beaten track;
    - Dare to question the ways of doing things;
    - Change the paradigms;
    - Use all the leeway permitted by law;
    - Do not settle for the lowest compliant price.

Learnings and benefits

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
5. Feedback on learning
    1. Observations
    2. Available tools
    3. Testimonies
    4. Benefits

- Available tools:
    - Validate our results with proven methods;
    - Use the mathematic tools available;
    - Meet with specialists.
- The members of the selection committees would like nothing better than to experiment new avenues, because they are jaded.

Learnings and benefits

1. Introduction and contextual setting
2. Presentation
3. What are we facing?
4. Problems with typical structures
5. Feedback on learning
    1. Observations
    2. Available tools
    3. Testimonies
    4. Benefits

- Benefits
  - Better transparency;
  - Motivation of the committee members;
  - Better controlled quality/price selection;
  - Better use of public funds.

Questions?

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President

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Director of procurement

City of Lévis

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Thank you for your attention!