Data Mining inspired Sensory Mapping Algorithm.

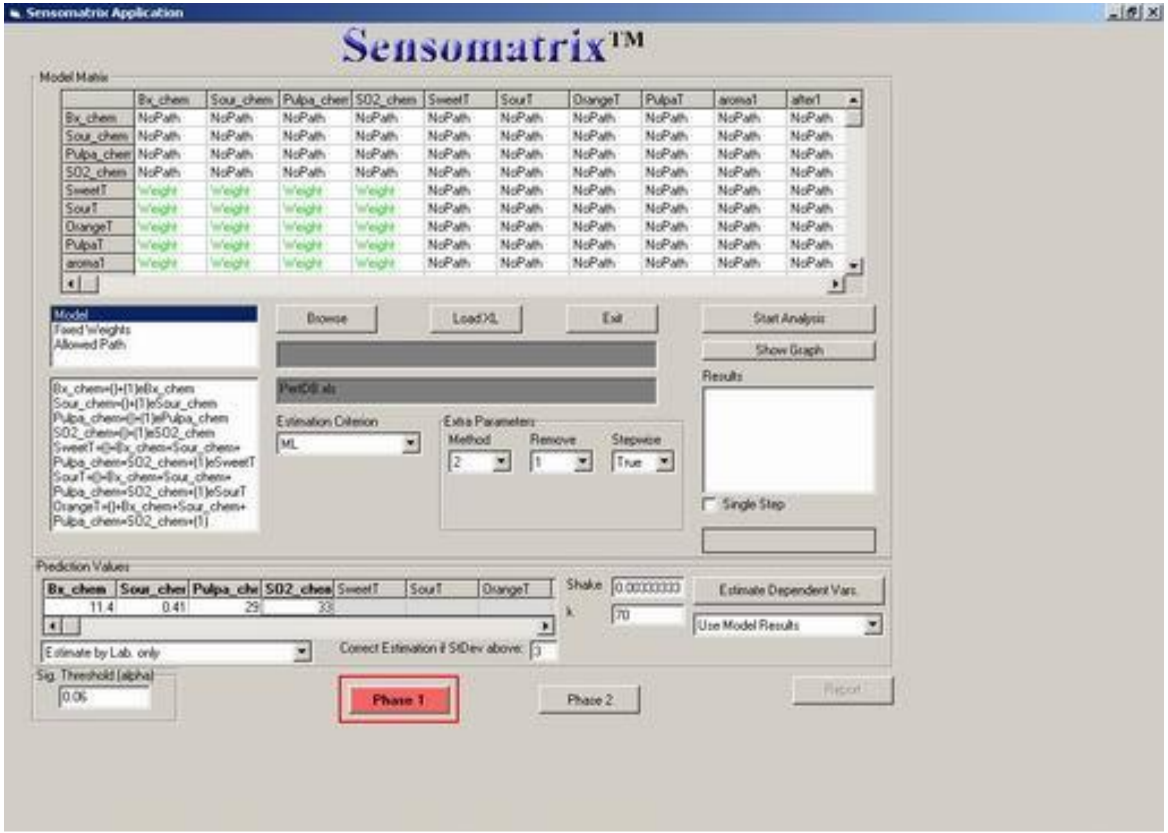
UDI. E. MAKOV , MICHAEL BEN-ASSOR
and I. SAM SAGUY

- Existing methodologies cannot accurately establish the complex relationship between analytical measurements, consumer sensory responses and purchase intent.
- This is mainly due to their inability to model the interdependence between the pertinent variables.
- Consequently, product developers and marketing practitioners are still searching for the “best” course that is likely to enhance product acceptance/sales.
- Sensory Mapping Algorithm exploits the versatile Structural Equation Modeling (SEM), a methodology that combines the properties of casual econometrics models with factorial analysis.

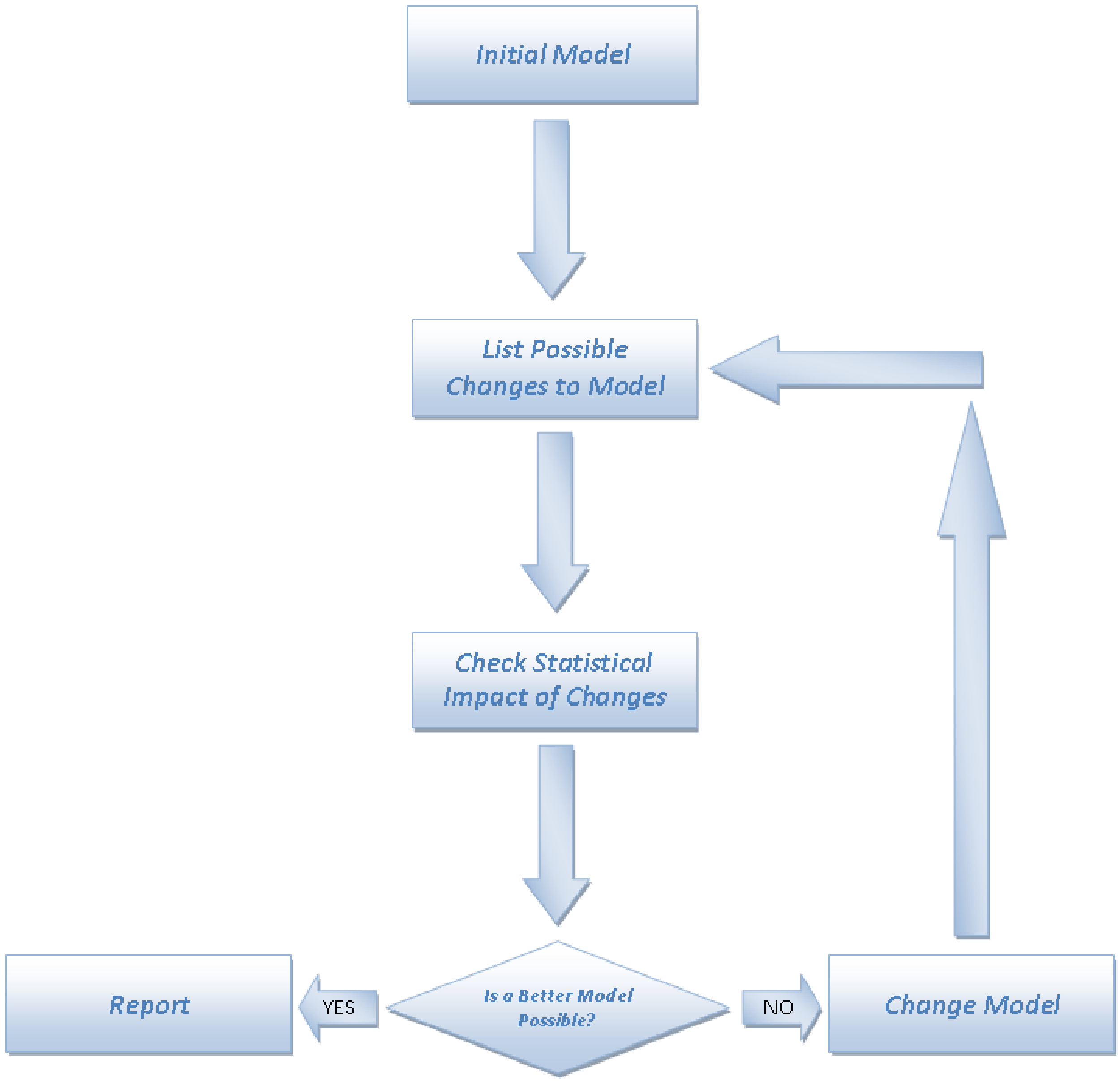
The algorithm is guided by the following assumptions

1. Customers' response is subjected to measurement errors.
2. Physicochemical variables are affecting sensory attributes either directly or via a latent variable, depicting an unobserved interaction between some of the physicochemical and sensory variables.
3. Sensory attributes possess errors in their measurements, an error that manifests the variability in the subjective assessment of the respondents.
4. Sensory attributes may be interrelated.
5. Degree of acceptance (or purchase intent) is not affected by physicochemical concentration directly, but through the sensory attributes.

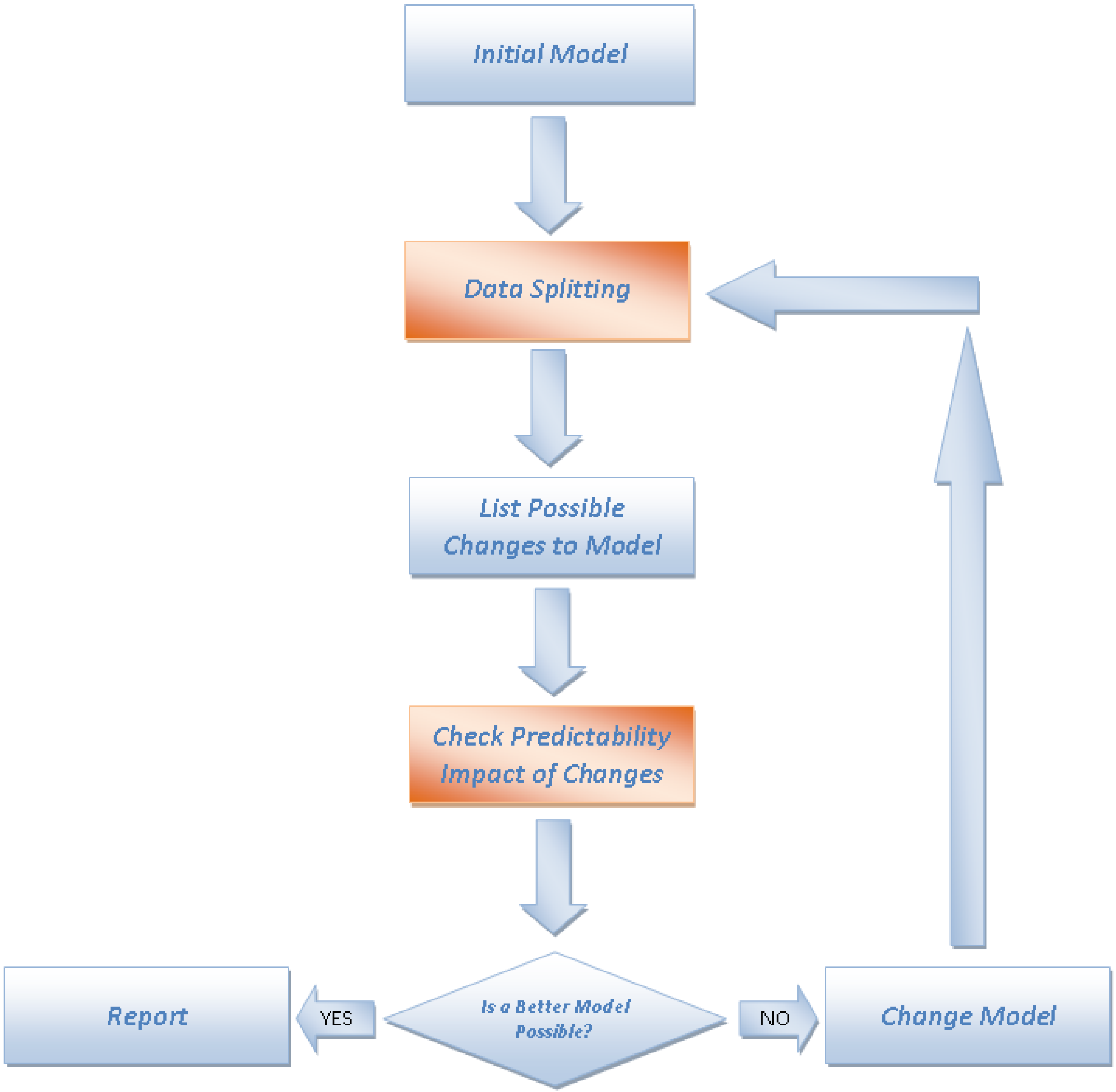
Sensomatrix™
Dialog boxes



Flowchart of Sensomatrix® – Phase I



Flowchart of Sensomatrix® – Phase II



The SMA comprises of four phases

1. The technological phase, relating physicochemical values to sensory attributes.
2. The sensory phase, relating sensory attributes to purchase intent.
3. The prediction phase, predicting purchase intent of an R&D product using a suggested physicochemical profile.
4. The validation phase, assessing the validity of the model and its predictive power.

Numerical study

Aim:

To develop a model for predicting purchase intent for orange drinks by linking product physicochemical data (e.g., solids content, pH, acidity, SO_2, pulp concentration) with sensory evaluations; and to verify model accuracy for predicting purchase intent.

Table 1: Average analytical properties				
Beverage	°Bx	Acidity (%)	Pulp	SO_2 (ppm)
A	11.20	0.42	34.00	21.00
B	11.50	0.52	35.00	27.00
C	11.20	0.42	32.50	25.00
D	11.20	0.42	47.50	0.00
E	10.90	0.42	50.00	68.00
F	10.60	0.41	20.00	64.00
G	11.00	0.47	29.00	21.00
H	11.10	0.52	32.00	19.00
I	11.20	0.45	35.00	16.00
J	11.30	0.40	0.00	0.00
K	11.30	0.40	40.00	0.00
L	11.00	0.42	50.00	61.00

Table 2: Average sensory evaluation and purchase intent (0 - lowest to 99 - highest)							
Orange drink	Sweetness	Sourness	Fruit flavor	Pulpiness	Overall aroma	After-taste	Purchase intent
A	88.4	91.5	87.2	85.8	66.3	2.8	72.5
B	88.1	91.5	86.4	85.1	67.8	3.0	73.0
C	88.2	89.0	86.7	85.7	69.4	2.8	71.6
D	88.8	91.0	89.2	86.1	75.4	3.7	78.6
E	87.8	87.1	87.4	88.1	74.8	3.6	75.3
F	88.3	89.4	86.4	85.3	68.7	4.9	69.7
G	88.1	88.0	85.4	84.9	68.4	3.1	75.1
H	88.2	90.0	85.9	85.2	66.7	3.0	74.0
I	88.5	90.3	86.9	86.5	69.2	2.7	74.0
J	89.9	90.1	90.7	89.3	76.6	2.5	77.6
K	88.6	93.0	90.6	87.7	75.2	1.8	79.6
L	88.4	91.3	89.0	84.4	71.6	2.5	75.1

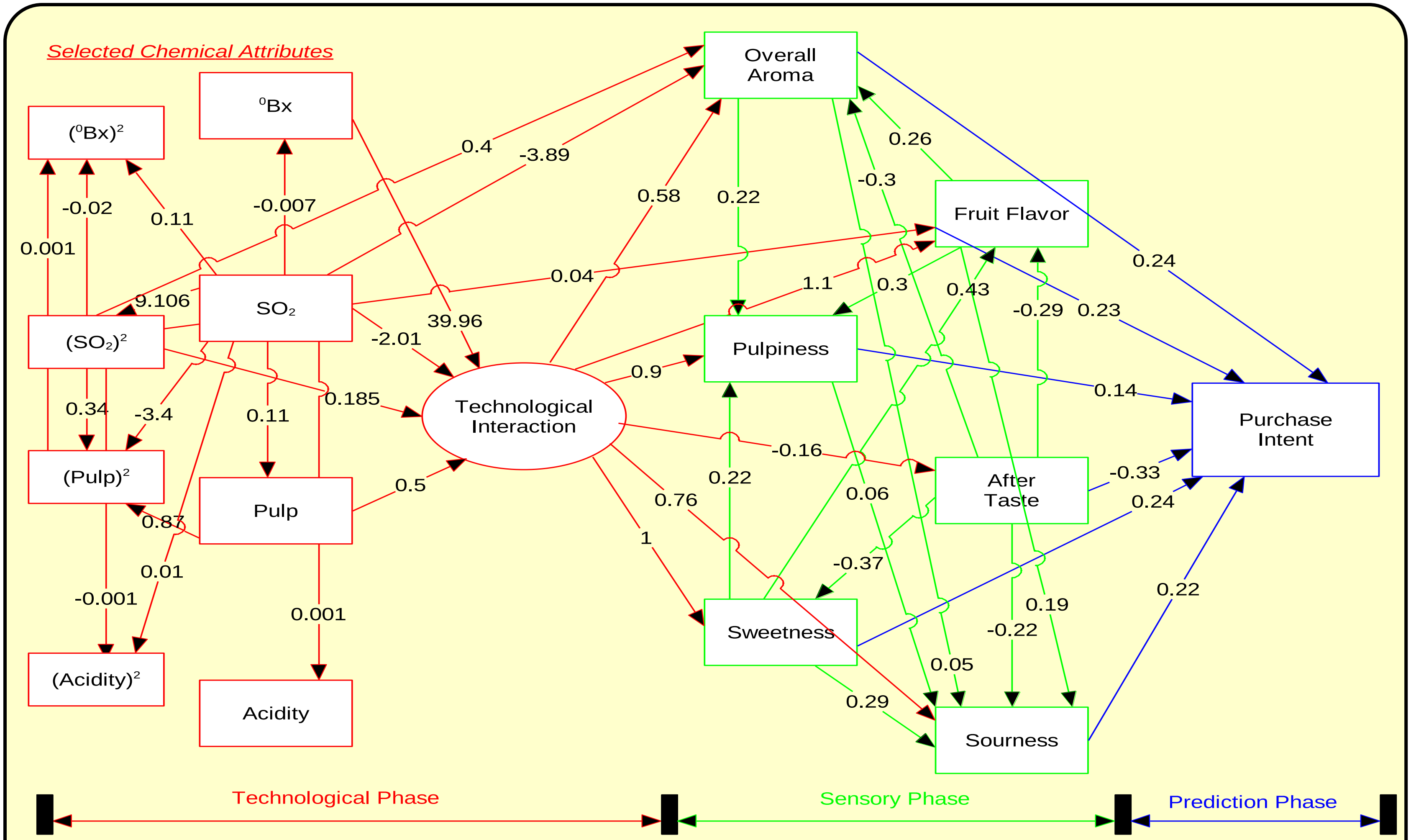


Figure 1: Sensory Mapping via Sensomatrix® – Phase I

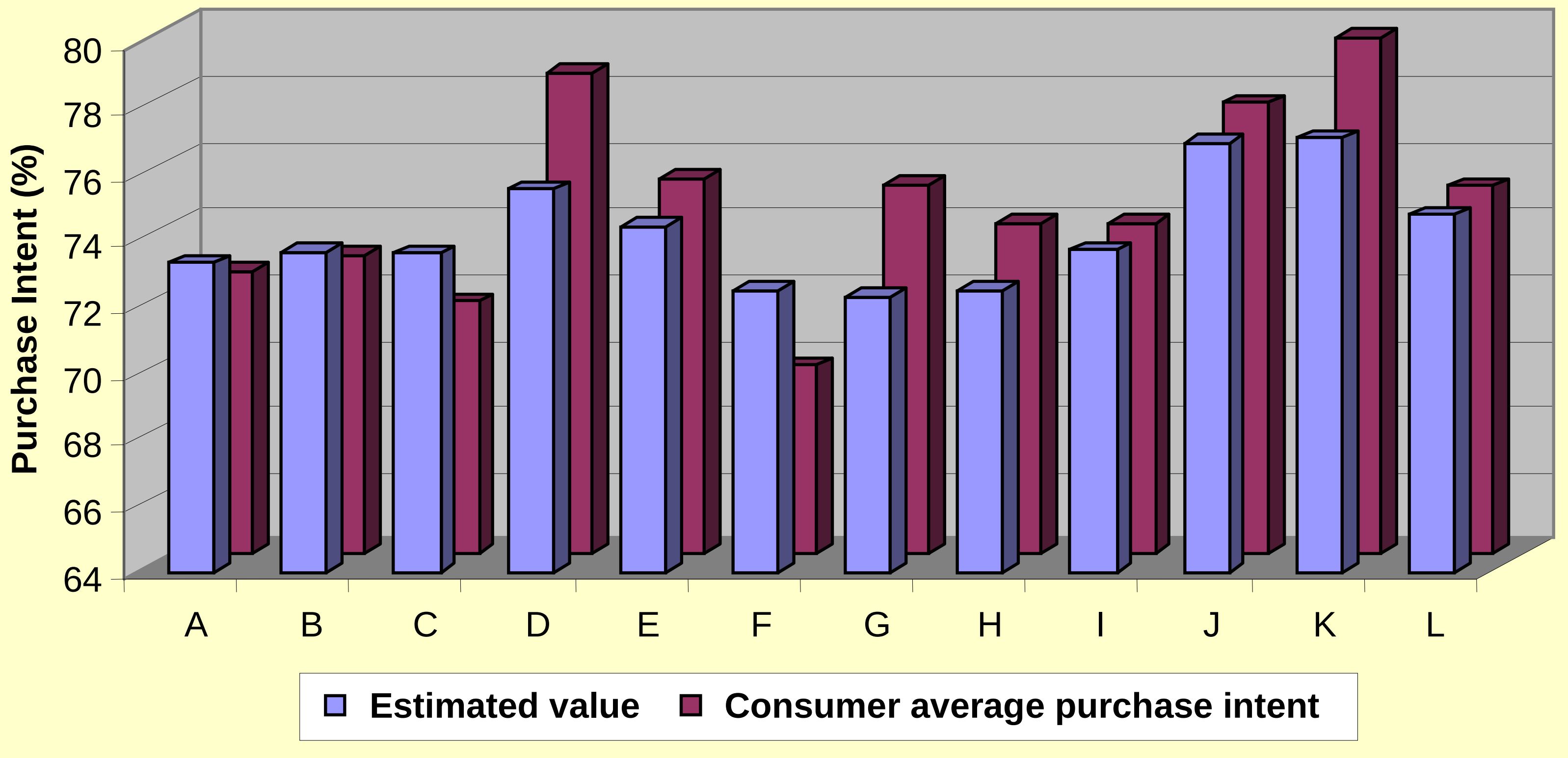


Figure 2: Actual and estimated purchase intent

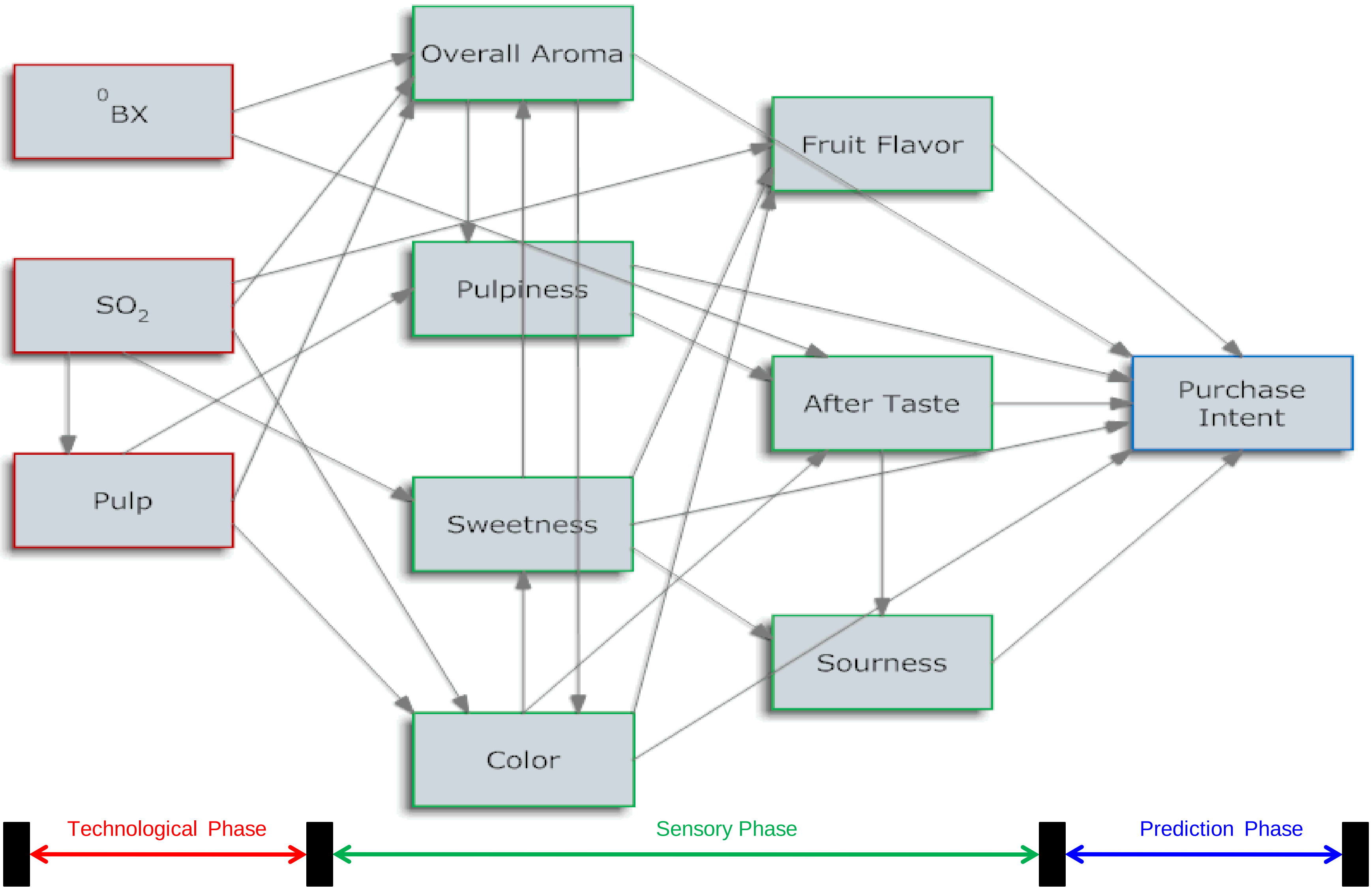


Figure 3: Sensory Mapping via Sensomatrix® – Phase II

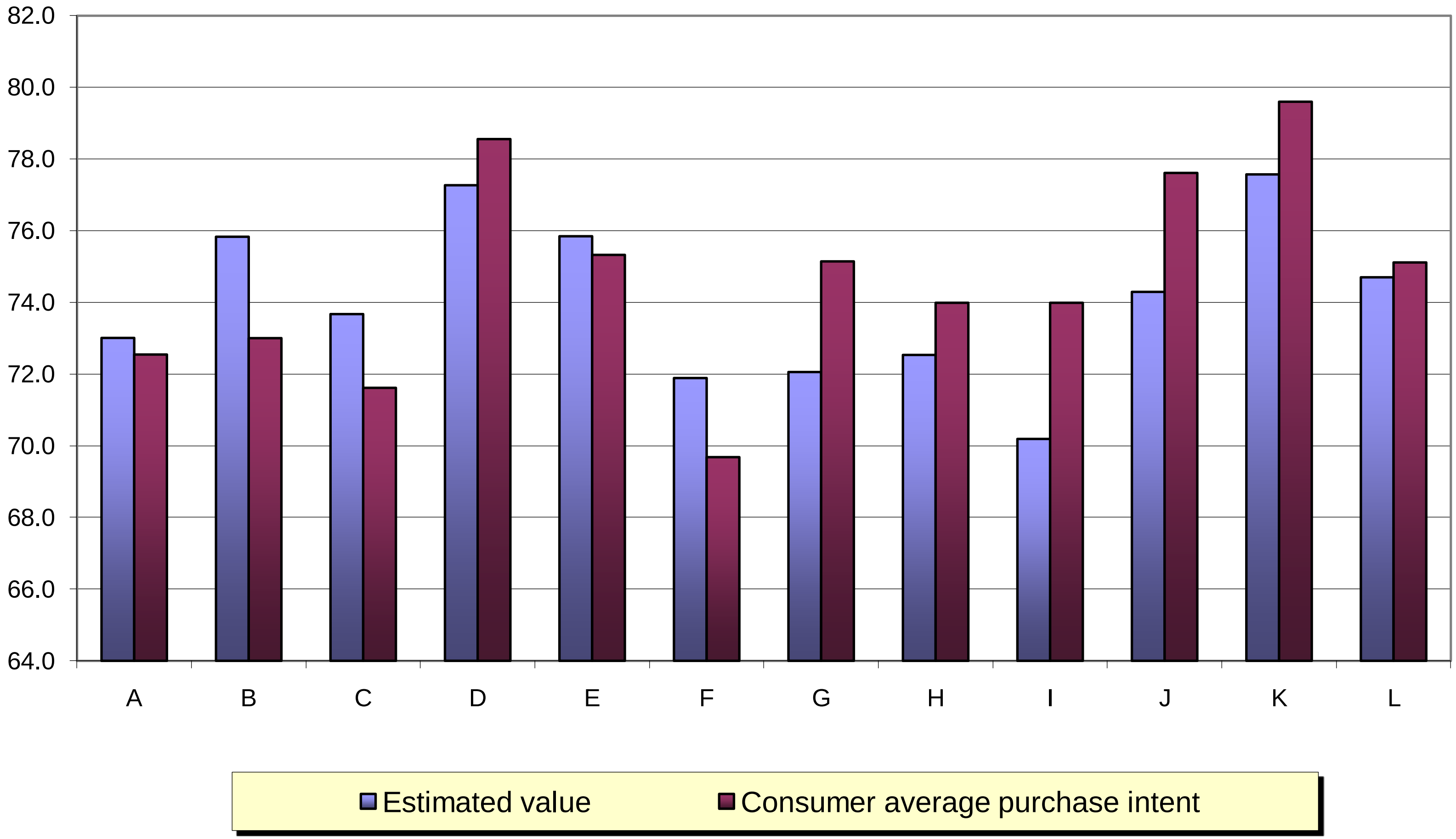


Figure 4: Actual and Estimated Purchase Intent

Conclusions

- The results demonstrated that the model could successfully relate analytical data (physicochemical composition and physical properties) with sensory evaluations and consumers’ purchase intent.
- The model is also able to predict, quite accurately, consumer’s response and purchase intent of a product for which only a laboratory profile is available.
- Once the parameters of the model are derived, the assessment of the direction the product development practitioner should follow can be based entirely on the model prediction, circumventing the need for extensive and expensive improvements steps, and sensory consumers' studies.
- The model could be used to significantly shorten product development and increase its overall chance to compete successfully in the marketplace.