WHITE PAPER: MILLING-BAKING INDUSTRY REVIEW

The Evolution of Wheat Flour Quality Control for a Changing Industry

How We Have Transitioned from Protocols of the Past to a Process/Technology-Driven Future

Enter: The Roller Mill

For ages, stone milling was the primary method for producing flour. Between 1830 and 1850, the first roller mill experiments were done in Switzerland and Austria. In the 1860s, the first Hungarian millers adopted modern technology; Ganz Works built the first complete roller mill system for the Hengerzsémalon (Roller Mill) in Budapest (Hungary). It was rapidly followed by France, Germany, Britain, and USA. Soon after, Minneapolis, Minnesota, USA, became the milling capital of the world in 1880.

This period began a deep milling revolution. Stone mills mainly produced dark flour; there was no real “white flour” in stone milling during this period. Flours were coarser, even if manually bolted using fine (silk) cloth.

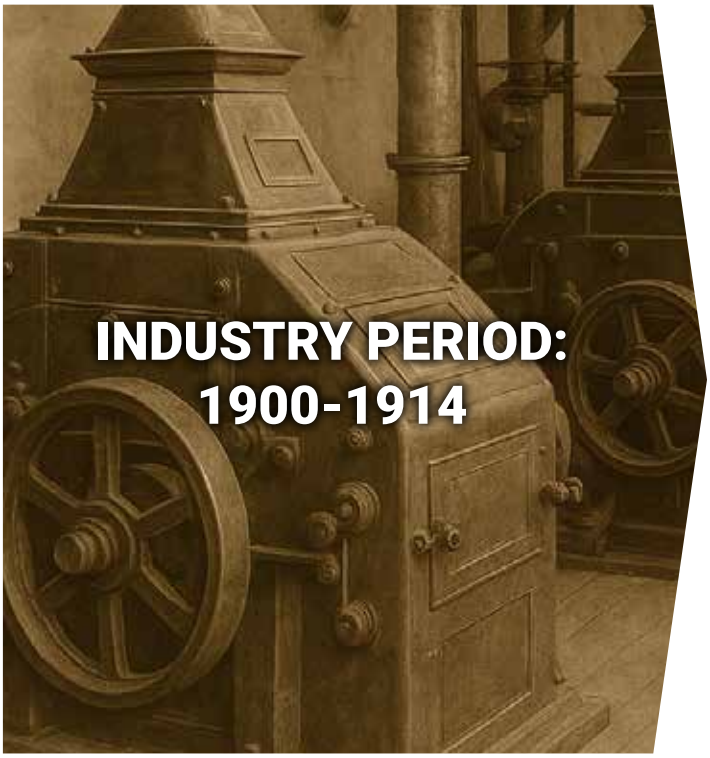
On the contrary, roller mills allowed efficient separation of bran and germ from the floury endosperm. This process allowed the production of whiter, finer, and more uniform flour. It also allowed increasing the extraction rate and opened the door to mass production. In 1930, only a few stone mills were remaining. Roller mills were dominating the market.

Nevertheless, millers and bakers always walk hand in hand. And if the millers found their big revolution at the end of the 19th century, the bakers had to wait until after World War 2, particularly the 1960s, to move from a small artisan bakery market to a large-scale automated bakery.

As the mills and bakeries grew, so did the need to ensure quality and consistency. These demands led to the rise of bread improvers and laboratory equipment companies.

It is essential to realize how these markets evolved together. When millers started producing more white flour, new opportunities opened for bakers. Baking operations became more industrial, triggering a stronger need for adapted and consistent flours. Bread improvers became essential part of this puzzle by linking baker’s needs with miller’s possibilities, thereby meeting all parties’ quality demands. And with each improvement, every change to a flour formulation had to be assessed, leading to the adoption of baking tests and laboratory tools.

The history of the evolution of these four essential players of the cereal chain is particularly interesting for those wanting to understand why things are what they are today and foresee potential challenges to come.



MILLERS
Millers are still transitioning from stone to roller mills during this period. More white flour is becoming available.

BAKERS
Bakers are primarily artisans during this time period. Most products are manually made.

BREAD IMPROVERS
Bread improvers at this time are limited to some malt flour (to correct low amylase activity). Sourdough is quite popular during this time.

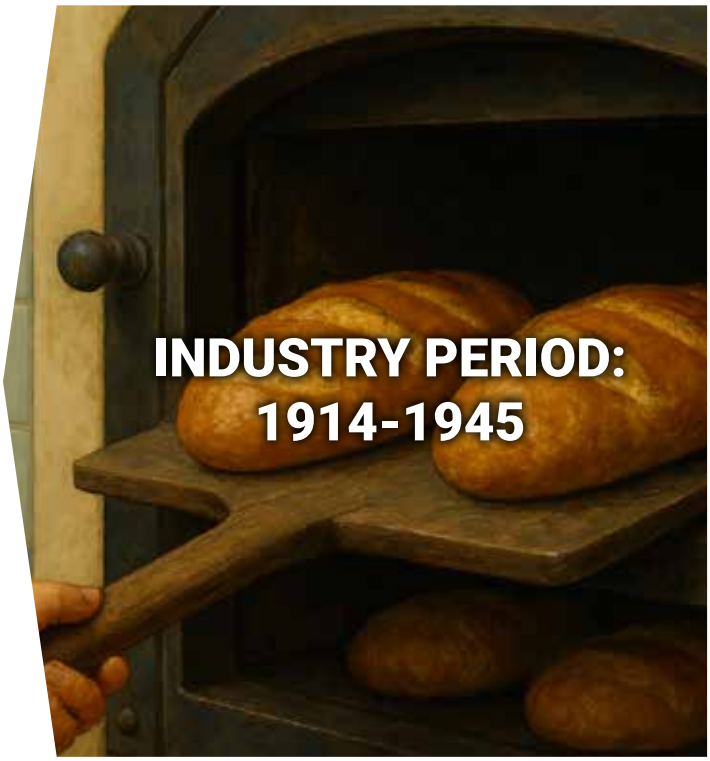
LAB EQUIPMENT
Lab equipment does not exist at this time; baking is the only way to assess flour quality.

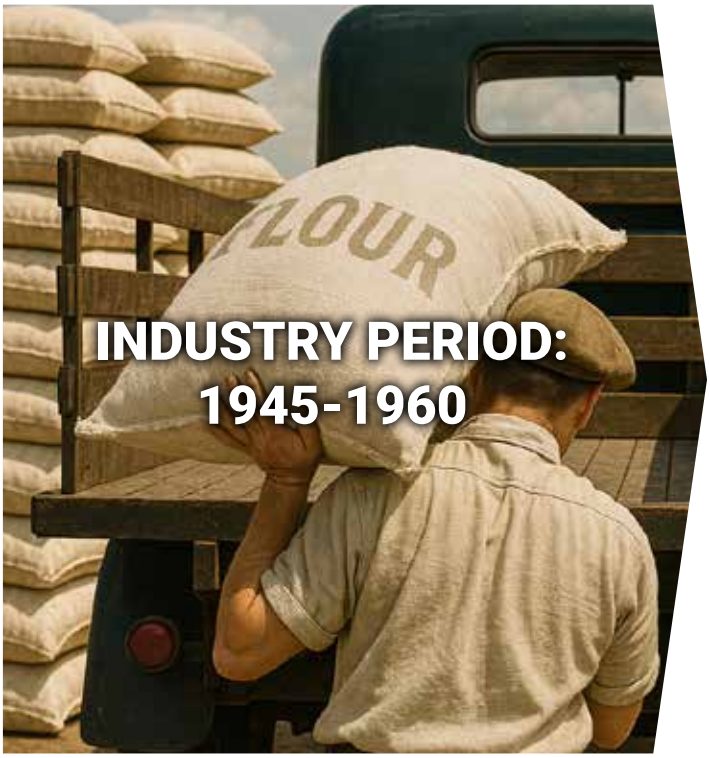
MILLERS
Millers have begun a shift toward lower extraction flours. Mills are also adapting to wartime needs.

BAKERS
Primarily making wartime breads with substitute flour (potato, barley, etc.). This period also marks the rise of central baking plants, and also the use of compressed yeast.

BREAD IMPROVERS
Bread improvers are still limited; no chemicals are used during this time.

LAB EQUIPMENT
The most famous instruments (for example, the Alveograph) were introduced in the early 1930s. World War II rapidly limited their distribution, and they remained confidential. However, users developed protocols to address market situations (wheat, milling, baking, and reflecting the reality of these times). The first edition of the AACC Standard method, released in 1916, mainly consists of basic chemical and physical grain and flour analyses (Moisture, ash, protein (Kjeldahl), gluten, sedimentation, etc.).





MILLERS
Industrial roller mills now dominate; refined flours are more uniform. The USA/UK mills have begun exporting.

BAKERS
Centralized bakeries and machines for mixing and shaping appear. The use of compressed yeast becomes the standard; sourdough fades in popularity.

BREAD IMPROVERS
Early oxidizers ($KBrO_3$), and malt enzymes are introduced; the first bread improver mixes emerge.

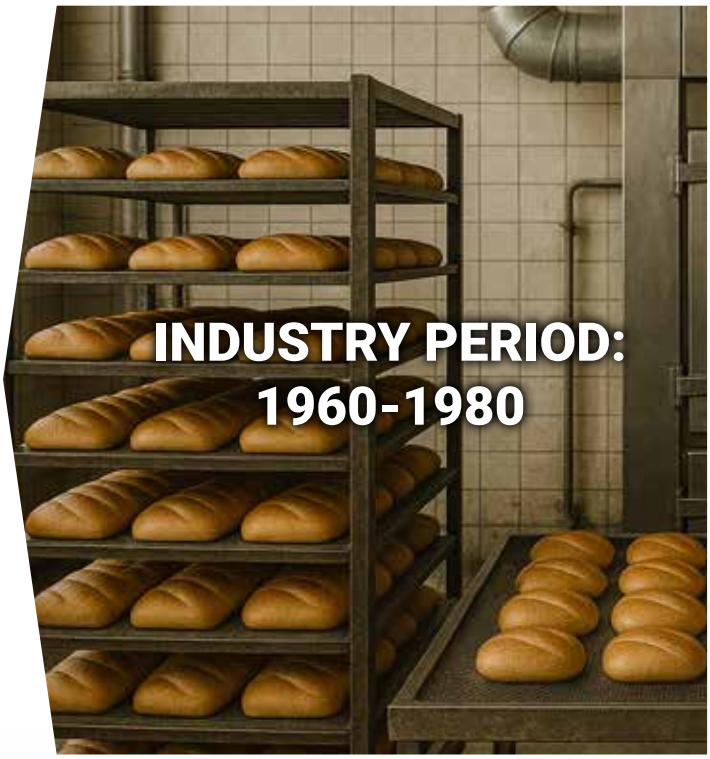
LAB EQUIPMENT
Use increases in the milling industry with the need to better understand the flour and the impact of the improvers. The Zymotachygraph (ancestor of the Rheo F4) was introduced in 1950. The AACC's first Alveograph standard was published in 1958.

MILLERS
A new standardization of flours dominates (T45-80 in France, 550 in Germany). Mills grow in scale and efficiency.

BAKERS
Industrial loaves are on the rise as regional style declines. Automation grows.

BREAD IMPROVERS
Widespread use of emulsifiers (SSL, DATEM, etc.), Ascorbic acid, and enzymes. Use of preservatives (propionates) also becomes more commonplace.

LAB EQUIPMENT
Equipment and tools are necessary in every milling company that is willing to ensure consistent flour quality for more demanding customers and constantly growing ones. It is also necessary to ensure proper wheat procurement. The Petrinex (ancestor of the Mixolab) appeared in the 1960s. The Alveograph becomes an official ICC method in 1966. The BIPEA (proficiency testing program provider) is introduced in 1970 to help laboratories ensure consistent and reproducible results. Specification books are increasingly more critical.



INDUSTRY PERIOD: 1980-2000

MILLERS

Global flour trade increases, and enrichment standards rise (iron, B-vitamins, folic acid, etc.). Revival of some stone mills in niche use.

BAKERS

More bakeries are opening within supermarkets, and inferior quality at this time triggers a resurgence of artisan bread (France, Italy) and a return to a more traditional offer of sourdough and spelt wheat.

BREAD IMPROVERS

Companies propose now tailored improver blends (to take customers' specificities into account), and we can also find bread mixes for baguette and ciabatta. On the other hand, some products are to be banned (like $KBrO_3$ in the USA and more).

LAB EQUIPMENT

Facing increasingly complex demands and searching to understand better flour's behavior (triggered mainly by bread improvers' potential), the instruments also had to adapt. Since the introduction of the first tools in the 1920s, the milling/baking/improver market has changed a lot. In parallel, the breeders have been working tremendously to improve wheat quality.

To address this new situation, CHOPIN Technologies (now KPM Analytics) introduced innovative solutions. The first model of Rheofermentometer (for measuring dough during proofing) appeared in 1994, and the possibility of testing Alveograph using adapted hydration was a reality in 1999 with the introduction of the Consistograph. The same year also saw the introduction of the Rapid F.T. in 1999 for rapidly measuring starch damage.

The original Rheo (Rheofermentometer) for measuring dough during proofing.

INDUSTRY PERIOD: 2000-2020

MILLERS

Two parallel trends arise: Hyper-efficiency roller mills, and the revival of local stone mills. Heritage wheat milling returns to address a consumer demand driven by “good for me” & less processed food.

BAKERS

Also, two parallell trends arise: The rise of craft bakeries and industrial bakeries, along with a fermentation science revival (sourdough) and diversification (gluten-free, wholegrain, ancient grains, etc.).

BREAD IMPROVERS

Mostly focused on enzyme-driven formulation (xylanase, amylase, lipase, protease…), need to provide clean-label improvers. Development of improvers for frozen dough.

LAB EQUIPMENT

Applications become extremely important as one needs to work in sometimes complex conditions (formulas with butter, egg, sugar…), and enzyme-based improvers are sometimes particularly challenging. Gluten-free products also emphasize the importance of starch in baked products.

Mixolab 1: 2005-2013

These trends led to the introduction, in 2005, of a new innovative tool, the Mixolab, which is able, in a single test, to give an extensive view of flour quality, looking at protein and starch, enzymes, and all interactions between them. The Mixolab became an ICC standard in 2006 and an AACC standard in 2007.

As standard methods are also increasingly becoming important worldwide, the period was also characterized by an intense effort to provide recognized standard methods respectively for the Rheo (AACC in 2001), the Consistograph (ICC in 2002; AACC in 2004), and the SDmatic (ICC in 2005; AACC in 2006)

Mixolab 2: 2013-2025

INDUSTRY PERIOD: 2020-Present Day

MILLERS

Sustainable milling (carbon reduction), smart sensor, real-time (online) flour control, demand for traceable wheat.

BAKERS

A rise in micro bakeries, local grain movement, digitalization, health-forward baking (Low GI, Low FODMAP. Tension on raw materials prices, expert bakers retiring, and not being replaced..

BREAD IMPROVERS

Shift to clean labels and enzyme-only, multifunctional natural blends (fiber + shelf life + dough strength)

LAB EQUIPMENT

Tools now have two purposes. The first, classical one, is to assess the quality of wheat flour, mainly to ensure it fits specifications. The second is to help link flour, improvers, formula, and the final product. This second use is undoubtedly the most crucial part as it is where companies can speed up their go-to-market time and save a lot of time and resources by smartly bringing baking test and dough testing tools. However, this use is only successful if it fulfills three conditions:

Mixolab 300: Introduced in 2025.

- **Stop guessing, start measuring:** each situation is different, and only working closely with the one making the product can help you understand what is good for them.
- **Time to refresh your protocols:** Remember that the protocols we used were designed about 100 years ago to reflect the industry reality of this very moment. Today's conditions are different, and yet we continue using the tools the same way when they can be adapted (many examples starting with Adapted hydration Alveo, Whole wheat analyses).
- **Use new and adapted tools:** The Mixolab 300, launched in 2025, with its ability to test dough directly from the production lines (or from the bake lab) and analyze it in an adapted but precise way, clearly opens new possibilities, like understanding cake batters and how to replace eggs in a formula, and more.

All Actors in the "Cereal Chain" are Intimately Bound

Bread improvers have supported the industry's need from artisan bread to large-scale production plants. They offered us a product that allows the dough to be processed efficiently and consistently. Combined with the producers of production lines, they made it so that today there are only a few products that cannot be produced in a high-throughput line. And with decent quality.

After the "consistency," they had to ensure the "diversity," as consumers wanted to access more diverse products. We started seeing mixes with all kinds of cereals, grains, starches, and fibers, and thus, we also began to need different tools or unusual ways to use them.

Enzymes, their specificities, and the possibility of formulating clean-label improvers were real game changers. Here again, the appearance of new systems to better understand what's in the flour (Starch damage) and what happens to a dough during critical phases, such as Mixing (Mixolab), shaping (Alveo), or proofing (Rheo), is a precious support that can perfectly complement the baking test when developing a new product.

The impact of these challenges on laboratory equipment manufacturers is real. Some argue that these tools have been used for decades, and there is no reason to change such well-established standards. It can be OK to some extent because most of our "knowledge" is based on these standard methods. But simultaneously, these standards represent a long-time-past reality. Simply put, it is using the current standard to obtain 100% of the information needed (for QC or NPD), which is perfect, but what if it is not? The point is that we do not need to forget standards; it only means that, besides them, we should put in place new and adapted tools and protocols tomorrow because you cannot move fast while looking in the mirror. The good news is that most of them already exist!

What is next? Time will tell, but one thing is sure: the industry will continue to propose exciting challenges, but **KPM stands ready to collaborate with customers and partners to find the most appropriate solution.**

About the Author

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Arnaud holds a Master in Sciences and Techniques for the agro food industry and a Master in International Marketing and Strategy. His original background comes from Biochemistry and he also holds a miller's degree from the French Milling School (ENSMIC).

He started working for CHOPIN Technologies, a KPM Analytics brand, in 1989. His various occupations in the company (he started as an after sales technician) puts him in constant contact with flour producers or users worldwide.

Arnaud is a standardization expert for AFNOR, ISO and CEN. He is active with the BIPEA, corporate member representative for ICC and is also actively involved in Cereals and Grains standardization working groups.

Let's begin the conversation to help you develop a new strategy to reduce waste, save costs, and improve production efficiency. Contact us today at sales@kpmanalytics.com.

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