



# Weeds, heat and pure cultures – On the differential success of new technologies in the Danish and American creamery industries in the 1890s

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## Abstract

Danish creameries introduced with government support pasteurization of cream during the 1890s which necessitated use of starter cultures to replace the heat-killed indigenous cream micro-flora. The Danish creameries exported the majority of their butter to the UK market that preferred a rather bland flavor. The US creameries did not implement pasteurization of cream successfully at that time. The primary reason for this outcome was that butter made from pasteurized cream lacked flavor components preferred by the American market. The US creameries experimented, however, with starter cultures to improve butter flavor, though without adopting the current best practice as they used unpasteurized cream. This study shows that differences in consumer preferences for butter flavor had a deciding impact on the introduction of new technologies to the creamery industry. This result anticipate current debates on introduction and diffusion of new technologies in the food industry.

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## Introduction

This study offers a comparative analysis of the diffusion of process innovation including introduction and adoption of a mild heat treatment (pasteurization) and commercial starter cultures to the Danish and US creameries in the 1890s. The focus on diffusion of process innovation has generally been on whether or not new technology is successfully introduced although some studies in recent years have also examined the issue of how new technology is adopted (Battisti and Stoneman, 2003; Henriksen and Hviid, 2005). This study focusses on the role of three potential drivers of diffusion – government policy, information spreading or knowledge communication and especially suppliers (i.e., the creameries) decisions in light of market conditions. The role of government policy for introduction and adoption of new technologies has been extensively investigated for Danish butter creameries from the 1870s and onwards (Kildebæk Nielsen, 2002, 2003; Leisner, 2002). This success story is in this study compared with the contemporary situation in another butter producing country, USA. The link to current debates on diffusion of new technologies in the food industry such as the introduction of genetically modified foods is discussed.

## The technological role of pasteurization and starter cultures

The 1890s were exiting years for the butter industry worldwide due to the successful introduction of two technological innovations in Northern Europe, in particular Denmark: pasteurization of the cream and use of lactic acid bacteria (LAB) as “starter cultures” for the souring of cream during ripening and for production of flavor compounds.

LAB are commonly applied for food preservation as well as for obtaining high standards for nutritional, sensory and health properties of food products. Their successful application is to a large degree determined by the level of the indigenous microbial flora in the food products, contemporarily described as “weeds” in a field (Farrington and Russell, 1898). The application of LAB is frequently combined with other factors aiming at reducing the growth and/or survival of the indigenous flora such as by a mild heat treatment (pasteurization). Pasteurization of the cream used in butter production was, however, notably in US but also to some degree in Denmark a technology under dispute by the end of the 19th century due to the indigenous background flora it eliminated contributed to the aroma profile (Farrington and Russell, 1898; Conn, 1902, p. 236; Hayward, 1904 and to some extent Jensen, 1891, Mt<sup>1</sup> 4: 305). Pasteurization resulted in butter with a rather mild/bland flavor that many customers would not immediately appreciate.

The Dane V. Storch (Table 2) was a pioneer in the 1890s for development of starter cultures for the butter industry including the LAB species, *Lactococcus lactis*. Commercial cultures were made available in Denmark in 1891 (Table 1). It was

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<sup>1</sup> Mt = Mælkeritidende.

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