

1 Crafty marketing: An evaluation of distinctive criteria for “craft” beer

2 **Abstract**

3 *There is increasing consumer demand for craft beer, and for clarification of its definition in the face*
4 *of widespread (mis)marketing. In recent years many small scale and independent breweries have*
5 *been purchased by large brewing organisations vying to get a share of the growing and profitable*
6 *niche market in craft beer. This raises the question of whether the beer produced by such breweries*
7 *can still be defined as “craft”. Are there other factors that should be taken into consideration when*
8 *defining genuine craft breweries? From the perspective of a consumer who seeks a craft product,*
9 *little is known about how and where the beer is produced, and when labels are taken at face value*
10 *there is a greater responsibility for retailers to distinguish between craft and mainstream beers. In*
11 *this paper we explore the conceptual and practical aspects of defining craft beer, with reference to*
12 *definitions established by various national industry associations.*

13 **Key Words:** *Breweries, Microbreweries, Authenticity, Ales, Provenance, Sustainable Sourcing*

14 **1. Introduction**

15 **1.1 Consumer perceptions of craft beer**

16 Craft beer is often perceived by the consumer to originate from small and independent breweries
17 that produce small batches of beer using the highest quality raw ingredients employing traditional
18 brewing processes to produce an end product that is of superior quality in terms of distinctive taste
19 and aroma (Kleaban and Nickerson, 2012; Gómez-Corona, Escalona-Buendía, *et al.*, 2016). This is
20 important given that the growth of the craft sector is down to consumer demand for a unique
21 experience that may not be offered by beer produced by multinational organisations (Gatrell, Reid
22 and Steiger, 2018). Studies have shown that consumers apply a higher sense of value to an
23 organisation that is seen to be “authentic” (Kovács, Carroll and Lehman, 2013) as opposed to
24 “industrial”. Consumers’ ability to distinguish between a craft and non-craft beer is often limited to

25 information displayed on the product label, and there are no clearly defined boundaries between
26 mass-produced and craft beer. Market research by Mintel found that 44% of consumers would like
27 a credible system of certifying craft beer (Mintel, 2017). As previously suggested, brewery size alone
28 may not be a reliable indicator of craft beer, as there are a multitude of other factors that may
29 differentiate craft beer from generic beer. In essence and generally speaking a craft product is
30 considered to be of superior quality, to be handmade and often produced in small quantities (Fillis,
31 2004). The crafts person is often trained on site by an experienced master crafts person with some
32 time spent at college learning the academic principles (Gamble, 2001). Sennett states that “all
33 craftsmanship is founded on skill developed to a high degree” and further notes that all forms of
34 crafts are highly advanced skills developed over upwards of ten thousand hours of experience, as an
35 individual’s skill develops their abilities become more “problem attuned” and able to make decisions
36 on how to overcome more complex tasks – unlike the untrained individual who may struggle with
37 basic tasks (Sennett, 2008). Rice (2016) discusses the “revolutionary” nature of craft beer that
38 should be distinguished by the characteristics of “small” and “authentic”, in contrast to “generic”
39 industrialised brewing processes. The authors go on to highlight the coexistence of both “authentic”
40 craft and the “inauthentic” crafty (Rice, 2016). It is also possible to find beer at the local supermarket
41 that is branded as own brand and described to fit in to the craft range.

42 The growing consumer demand for craft beer has not gone unnoticed by the leading global beer
43 brands. Alcohol consumption in the UK has been steadily declining since 2004, and multinationals
44 and established regional breweries are attempting to gain access in to the growing craft sector by
45 either releasing beers described as craft beer or acquiring already established breweries such as
46 Meantime and Camden Town brewery (Davies, 2015; Farrell, 2015). The growing trend of
47 multinational organisations taking over independent breweries in order to sell craft beer has been
48 coined as “craft washing” in recent work (Howard, 2017; Wallace, 2019). The lack of clarity on the
49 term craft beer has left this industry segment open for the large scale breweries to produce new

50 beer ranges that may be craft in name only, and that may not be produced using the traditional
51 methods associated with a traditional craft brewery (Rice, 2016).

52 **1.2 Existing definitions of “craft”**

53 The Brewers Association in the United States (USA) have taken the approach of defining craft beer as
54 being sourced from a craft brewery that is verified as such by successfully meeting a set of pre-
55 defined criteria. The Brewers Association is a not-for-profit organisation that represents small and
56 independent breweries in the USA (Brewers Association, 2019). Their definition of a craft brewery is
57 based on three characteristics (Brewers Association, 2018b): (i) having an annual production up to
58 7,040,867 hl or 6 million beer barrels (US); (ii) no more than 25% of the business is owned by
59 another “beverage alcohol industry member”; (iii) possessing a “TTB Brewers Notice” and produces
60 beer as opposed to contracting this to a third party. Breweries that meet all three criteria can freely
61 use the Brewers Association seal mark on their labels. To date, 4818 breweries in the USA use the
62 seal to promote their beer, over 85% of members (Brewers Association, 2018c). The Society of
63 Independent Brewers (SIBA) who represent brewers in Britain have also created a seal mark similar
64 to the Brewers Association in the USA. To qualify for SIBA’s seal, Brewers must meet two
65 characteristics (SIBA, 2018): (i) compliance with SIBA’s food safety and quality standard; (ii) the
66 brewery is an independent brewery with no affiliation with another larger brewing organisation.
67 Eight hundred and seventy breweries currently use this seal, (SIBA, 2018). In contrast, 2378
68 breweries qualified for reduced duty, namely the small brewers relief, by having an annual
69 production capacity under 60,000hl in 2018 (Brewers of Europe, 2018). Thus, many small breweries
70 are not covered by the main industry seal for small and independent brewers, and it is fair to say
71 that the brewing industry is not as well represented as the USA. Meanwhile, the Italian government
72 has recognised the importance of the Italian craft beer sector and have taken a proactive approach
73 to protect the credibility of the craft market by passing a Law in July 2016 defining what can be
74 classified and thus sold as craft beer. This Law stipulates craft beer should originate from a small

75 brewery with an annual production of no more than 200,000 hl, that is operating independently of
76 any other brewery, and must not subject the beer to pasteurisation or filtration (Centinaio, 2016). In
77 this paper we critically evaluate criteria proposed by various industry associations and others to
78 define craft beer and select a relevant subset of these criteria that could be practically applied by
79 consumers or industry organisations to accurately differentiate craft beers.

80 **2. Methodology**

81 The aim of this paper is to explore whether objective criteria can be applied to define the term
82 “craft” beer by evaluating various characteristics proposed by industry associations, academic and
83 grey literature and discussions and viewpoints of independent brewing organisations in the UK. We
84 begin with the broader meaning of the term “craft”. What is a craft, how does one become a crafts
85 person (and how long would this journey take)? We then critically evaluate craft definitions
86 proposed by established industry associations in the USA and Britain. We conclude by proposing a
87 short-list of criteria that could be objectively assessed to define craft beers.

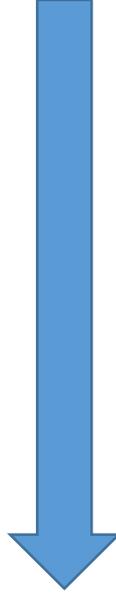
88 **2.1. The value chain of beer**

89 Many factors influence consumer perceptions on what is a “craft” beer such as local embeddedness
90 (Argent, 2018) sensory characteristics (Gómez-Corona, Escalona-Buendía, *et al.*, 2016; Gómez-
91 Corona, Lelievre-Desmas, *et al.*, 2016) and aspects relating to place making (Fletcher, 2016). We do
92 not address all of those factors in this paper, but focus on more technical criteria that could be used
93 to objectively define craft beer and underpin a verifiable label. To do this, it is first necessary to
94 consider the life cycle of beer production. The beer value chain has been described in Figure 1 by
95 dividing the stages of beer production in to four steps. Firstly, cultivation of the raw ingredients
96 includes all inputs (e.g. fertilisers), maintenance and harvesting operations prior to produce leaving
97 the farm gate (Kok *et al.*, 2018). This stage applies to any grown ingredients used in brewing,
98 including hops, barley and adjuncts such as wheat, rye and oats among many others. The second
99 stage covers the onward processing of the ingredients (Henderson and Miller, 1972). In the case of

100 barley this would involve allowing the barley to partially germinate followed by a period of time in a
101 kiln to roast the malt, depending on the type of malted barley being made (The Maltsters
102 Association of Great Britain, 2019). Following processing, ingredients would then be packaged and
103 prepared for delivery to a brewery. Stage three of the value chain includes all activities at the
104 brewery from goods arriving, through brewing processes, to the final products being packaged for
105 delivery. The brewing process itself consists of three initial stages (Gillespie and Deutschman, 2010).
106 Beginning with mashing where the barley and adjuncts are mixed with water and left to stand for
107 approximately one hour in a vessel called mashtun. Next the liquid is drained from the mashtun and
108 additional hot liquor is poured over the content of the mashtun to ensure any remaining
109 fermentable sugars are captured in a process called sparging. The liquid is transferred to a vessel
110 traditionally known as the copper or boil kettle. During the boil, hops are included to add bitterness
111 and aroma to the beer. The final stage of beer production starts with rapidly cooling the liquid from
112 the kettle in preparation for fermentation where yeast is added. The beer will remain in a fermenter
113 vessel – for ale this could be for between 7 and 10 days but for lager it can take a few weeks. Once
114 fermented the beer is stored in vessels for maturation then placed in kegs, casks, bottles or
115 aluminium cans ready to be distributed. The final stage in the value chain covers distribution from
116 the brewery to retailers. This is separated in to two sectors known as on- and off- trade; the former
117 represents pubs, clubs and restaurants and the latter shops and supermarkets.

118
119
120
121
122
123
124
125
126

Figure 1 Beer value chain

<p>Growing, cultivating & harvesting raw ingredients</p>	<p>Traditionally, barley has been the main source of fermentable sugar used to produce beer together with a number of adjuncts such as wheat, oats and rye. They are included for qualities such as flavour, mouth feel and head retention. These are included in the early stage of brewing known as the mash. In the boiling stage of the brewing process the hops are added these add flavour and aroma (Kok <i>et al.</i>, 2018).</p>
 	<p>For the purpose of this discussion the second stage of the value chain is from the farm gate, through the subsequent processing and packaging of major ingredients in preparation for use in the brewing process. Barley is processed by malting, which includes stimulating the barley to partially germinate before being heated in a kiln. The length of time in the kiln can result in a range of colour from light to dark beer. Other processes include drying of the hops, which is done to retain qualities such as colour, shatter, aroma, moisture content and alpha acidity (Henderson and Miller, 1972).</p>
<p>Brewing</p>	<p>This involves milling the barley to brake open the husk, then mixing with other adjuncts depending on style and recipe in the mashtun which is soaked in water at 68 C for a period upwards of 60 minutes. The mashtun is then drained of all liquid, and to ensure all fermentable sugars are extracted from the mashtun a process named sparging is employed, involving spraying hot water over the content of the mashtun. The extracted liquid is named wort and is transferred to a vessel named a kettle for rigorous boiling again for a period upwards of 60 minutes, with hops added at different intervals. Once complete the wort is transferred to a fermentation vessel where yeast is added. A fermentation can take upwards of 7 days depending on style of beer. Once fermented the beer is stored in a maturation vessel before it is packaged in to either keg, cask, bottle or can ready for distribution. Once matured, beer can be pasteurised or filtered, though this is not carried out at all breweries.</p>
	<p>Once packaged the beer is ready for distribution, beer sales are split in to two sectors, firstly on trade meaning pubs, clubs and restaurants who sell beer in cask, keg, bottle or can and the off trade such as food and drinks retailers like supermarkets selling only bottles and cans.</p>
<p>Distribution & retail</p>	
	

128 **2.2. Criteria identification**

129 First, a comprehensive list of possible defining criteria was created. Possible criteria were collated by
130 firstly taking reference of industry association seals, as mentioned above, to establish criteria in
131 current use (Brewers Association, 2018c; SIBA, 2018). This was followed by an extensive literature
132 search of peer reviewed articles and grey literature using search words such as “craft”, “beer” and
133 “brewing” (Bastian *et al.*, 1999; Fillis, 2004; Thurnell-Read, 2014; Elzinga, Tremblay and Tremblay,
134 2015; Fastigi *et al.*, 2015; Wells, 2016; Frake, 2016; Gómez-Corona, Escalona-Buendía, *et al.*, 2016;
135 Rice, 2016; Howard, 2017; Gatrell, Reid and Steiger, 2018). There has been some work in recent
136 years on consumer perception (Gómez-Corona, Lelievre-Desmas, *et al.*, 2016; Gómez-Corona *et al.*,
137 2017), but we look to the industry and producers for their perspectives, including recent discussions
138 in the brewing industry about independence and ownership disseminated on social media platforms
139 such as Facebook, Twitter and Instagram by many brewing organisations. Three social network sites
140 have been selected to gain the viewpoints of breweries on the matter of multinational brewing
141 organisation ownership of “independent” breweries: Facebook, Twitter and Instagram accounts of
142 76 breweries were followed. The methodology used for tracking discussion was social media opinion
143 mining (SMOM) a qualitative approach observing viewpoints expressed on social media posts.
144 Previous studies have utilised Application Program Interface to follow social media discussions on
145 topics of interest (Rahmani *et al.*, 2014). This was considered unsuitable as the results would include
146 public discussion. We observe the discussions, in this case the reaction to the news that a London
147 based independent brewery had received an investment by a multinational brewing organisation in
148 exchange for a share ownership in the business. The case study selected was a beer festival with a
149 global attendance of over 70 breweries organised by the brewery in question. The approach taken in
150 this case was to follow the accounts of the attending breweries.

151

152

153 **3. Outcome**

154 Following the comprehensive literature search it was possible to identify a total of six specific factors
155 that were highlighted as having a place in the overall discussion over craft and non-craft. Each
156 criteria was categorised as either an excluding or indicative criteria. Excluding criteria reflect an
157 activity or characteristic that is considered to preclude a beer from being defined as craft, whilst
158 indicative criteria represent factors that have been accepted by the sector as relevant but could not
159 be used to disprove or confirm any craft identity. The six criteria are summarised in Table 1.

160 Table 1. Shortlist of six criteria considered for craft definition

Source	Criteria 1	Criteria 2
Industry Association	Size	Ownership
Brewing Industry	Ingredients	High Gravity Dilution
Observation	Automation	Creativity & Innovation

161

162 **3.1 Brewery size**

163 Perhaps the logical starting point in the definition of craft beer would be to consider the first
164 defining criterion applied by the industry associations. Firstly, in order to avoid any confusion, it is
165 important to distinguish between the terms microbrewery and craft brewery. A microbrewery is
166 defined by size alone, falling below a certain output threshold, and may fall within the definition of a
167 craft brewery subject to other defining characteristics being met. According to the Brewers
168 association in the USA, a microbrewery has an annual production of up to 17,600 hl (Brewers
169 Association, 2018a) and according to their website there are 4,247 microbreweries in the USA at
170 present (Brewers Association, 2018d). As a defining criteria for a craft brewery, the Brewers
171 Association have a maximum annual company production threshold of 7,040,866 hl. The Brewers of
172 Europe classify microbreweries to be significantly smaller than the USA Brewers Association
173 definition, with an annual production up to 1000 hl (Brewers of Europe, 2017). The brewing industry

174 in the UK has no description of a microbrewery, but the UK Government allow tax benefits for
175 smaller breweries in the form of a small breweries relief. This is a tiered system allowing a 50% tax
176 reduction for the smallest producers of up to 5000hl per year, with allocated benefits applied to
177 larger breweries up to a maximum annual production of 60,000 hl. In recent years, many small scale
178 and independent breweries have been purchased by multinational brewing organisations (Furnari,
179 2011; Davies, 2015; Farrell, 2015; Hancock, 2018).

180 The larger annual capacity threshold for craft breweries in the USA is likely to reflect the generally
181 larger scale of brewing nationally compared with other countries. Specifying a maximum size for
182 breweries producing craft beer may be somewhat arbitrary given that beer produced by large
183 breweries could have many other qualities associated with craft beer. One example of this is the
184 Scottish brewery BrewDog who reported total beer sales of 436,994 hl in their 2017 brand overview
185 report (BrewDog, 2017). We will elaborate below important characteristics of BrewDog beers that
186 could define them as craft, despite the relatively large size of this brewer.

187 **3.2 Process control and production methods**

188 Process control via automation is playing an essential role in all aspects of plant operation at large
189 scale industrial food and drink production (Dahm and Mathur, 1990). This technology enables
190 autonomous production and monitoring of production plant but the outcome can erode human
191 responsibilities, and traditional human tasks may be substituted by automated machinery. Human
192 input may be confined to observation and monitoring of the process through a Human Machine
193 Interface (HMI) or control room (Wu *et al.*, 2016). Such modernisation of industrial production has
194 seen many human tasks replaced by computerised control systems. This is not to say that
195 automation does not have a place in a craft brewery. A modern bottling or canning plant for
196 example relies on automated control, and the advancing technology in terms of instrumentation can
197 provide a brewer with better control of the brewing and fermentation processes, ensuring the
198 quality of the final beer (Chakraborty, Roy and De, 2015). There are valid arguments for utilising such

199 technology in small scale production given the financial constraints faced by small producers with a
200 limited workforce. This matter is explored further in terms of both the benefits of such technology
201 and the potential conflicts with the concept of craft brewing.

202 The advantage of utilising automated technology is that allows for continuous monitoring of specific
203 parameters, thus ensuring that output is of the highest food quality standards. Plant down time can
204 also be reduced as equipment can be taken off line or isolated as part of the control and monitoring
205 – this feature prevents damage occurring to the equipment, for example pumps running dry, and
206 improves the overall economic efficiency (Livelli, 2012). Automation can also result in less produce
207 being wasted, by taking simple mundane tasks away from human control and reducing human error.
208 Water consumption is a factor that can be dramatically reduced by installing equipment that
209 measures usage, enabling better management (Laughman, 2017).

210 However a possible knock-on effect of employing such technology is the simplification of tasks and
211 transfer of responsibilities away from humans, leading to the possible de-skilling of workers and
212 ultimately reduction of staff numbers, though this is unlikely to be the case for a team at a small
213 brewery. Traditional techniques and practices that are learnt and developed by experienced crafts
214 people during a lifetime career could become redundant or unnecessary as tasks are taken over by
215 automation in the overall brewing process at modern day breweries. The skills acquired by
216 traditional brewers are of great importance for “occupational identity” (Thurnell-Read, 2014), and
217 are needed for the formulation of new beers. There is a risk that specialist brewing skills may not be
218 passed on to the next generation of craft brewers if reduced demand for these skills means that
219 there is little scope for training. When used in combination with automation, the skills of a
220 craftsperson may still be applied in the brewing process in a manner compatible with
221 “craftsmanship”. However, when data collected by monitoring devices are fed in to a Programmable
222 Logic Controller (PLC) processor that then controls tasks such as controlling valves, temperatures,

223 levels within vessels and running pumps via pre-written software code, the role and specialist input
224 of the craftsperson diminishes, potentially creating a valid exclusion criterion for craft beer.

225 **3.3 High gravity dilution**

226 As discussed in the beer value chain, high gravity dilution is undertaken by some breweries after the
227 fermentation stage. By measuring the original gravity from a sample of wort taken before the yeast
228 is added and then measuring the beer when fermentation has finished it is possible to calculate the
229 alcohol by volume (ABV) of the beer (Ferguson, 2016). Beer styles such as Belgian tripel, imperial
230 stout and barley wine are all examples of high gravity beer with alcohol content ranging from around
231 8 - 11% ABV or higher (Ferguson, 2016; Poelmans and Taylor, 2019). With high gravity dilution, the
232 higher alcohol content can be diluted with deoxygenised water, resulting in an increased volume of
233 the final beer at 11.5°Plato. It has been found that increasing the fermentation temperature to 18°C
234 can enable a high gravity wort of 22 °Plato to ferment within the same time as a wort of 15 °Plato.
235 Diluting down a 22°Plato wort can increase brewing capacity by 91%, whilst diluting down a 15°P
236 wort can increase brewing capacity by 30%, compared with aiming for a wort of 11.5°P (Lima *et al.*,
237 2011).

238 This procedure clearly has numerous economic and potential environmental benefits for industrial
239 brewing, including reduced capital costs, energy and water inputs per litre of beer produced.
240 However, this process does have some disadvantages including a reported decrease in “brew house
241 material efficiency”, a reduction in hop utilisation and has a negative effect on the head retention
242 (Cooper, Stewart and Bryce, 1998; Stewart, 2007). This process has previously been discussed
243 among craft brewers as one that could not be associated with craft brewing, given their focus is on
244 exploring new flavours (Watt and Dickie, 2013). For this assessment high gravity brewing is included
245 as an exclusion criterion however it must be noted that at present not all beer labels contain details
246 on the original specific gravity.

247 **3.4 Independent ownership**

248 The steady growth and subsequent industrialisation of large scale brewing has resulted in a small
249 number of multinational organisations retaining a large proportion of the beer sales market (Elzinga,
250 Tremblay and Tremblay, 2015; Fastigi *et al.*, 2015; Wells, 2016). Over the past decade multinational
251 breweries have taken aggressive measures to gain an advantage over their competitors to achieve a
252 greater proportion of the market share. The most high profile example was the acquisition of SAB
253 Miller by AB Inbev in a deal said to be worth £79bn making this the third largest merger in corporate
254 history leading to ABI being the largest brewing company in the world (Daneshkhu, 2016; Nurin,
255 2016). A growing trend within the craft sector has appeared where independent breweries are taken
256 over by multinational organisations. Meantime brewery was taken over by SAB Miller in 2015 and
257 later that year Camden Town Brewery was purchased by AB Inbev (Davies, 2015; Farrell, 2015).

Case study of Beavertown announcement of share sale to Heineken

On June the 21st 2018 Beavertown brewery announced on their social media accounts that they had sold a “minority” share to Heineken at a sum of £40 Million to fund the expansion plans including a new brewery in London to be called Beaver World. The explanation given for taking this action was that it was the only viable option to meet the growing needs of the business. After considering the other available options such as crowd funding, private equity and investment from other brewing organisations it was decided that no other funding program could meet the needs of the brewery given that the site in London was at maximum capacity and much of their beer was brewed under contract in Belgium. Therefore, the company required an immediate solution to meet the growing needs of the business. The Beavertown Extravaganza is a celebration of craft beer originally hosted at the Tottenham brewery in 2016. The event was moved to a much larger venue for 2017 in order to accommodate an expected footfall of 8000 people over the course of the weekend. The 2018 Beavertown extravaganza was a sell-out event with 90 breweries from all over the world in attendance (Craft & Slice, 2018); a showcase of some of the world’s most popular craft beer brands actively collaborating. Few other events in the UK include such a diverse line up. Following Beavertown Brewery’s investment announcement, reaction from the brewing community was largely negative and potentially damaging for the future of the Beavertown Extravaganza. The reaction began with the announcement by Cloudwater a brewery located in Manchester and an active collaborator with many craft breweries in the UK and overseas. They announced on their social media accounts that they had withdrawn from the 2018 event. This was followed by announcements from Buxton brewery, Brew by Numbers and Verdant in the UK with breweries like Dry and Bitter in Denmark and Jester King in the USA also following suit. Many breweries subsequently withdrew from the event and from monitoring the social media accounts of Beavertown. Over the following weeks, from the original line up of 90 breweries, 41 breweries had withdrawn from event.

This case study highlights the importance of ownership as an essential criterion of craft beer. This could also be interpreted as a form of self-regulation amongst the networks of craft breweries showing how independent breweries negatively view any association with big beer.

258

259 Recent studies led by Gomez-Corona categorised the beer industry as two sectors: craft and
260 industrial (Gómez-Corona, Escalona-Buendía, *et al.*, 2016; Gómez-Corona *et al.*, 2017). It could be
261 interpreted that based on this description beer not produced using industrial production methods
262 would necessarily be craft beer, and vice versa. Further consideration suggests that accurate
263 classification of craft beer is more nuanced than this. For example, a brewery employing small scale
264 manual production processes cannot be defined as craft if under the ownership of a multinational
265 organisation according to other existing criteria. Share ownership is acceptable in the USA up to 25%
266 for craft definition (Brewers Association, 2018b), but the Assured Independent campaign in the
267 Britain stipulates total independence as a qualifying requirement (SIBA, 2018). The flexible approach
268 of the Brewers Association allows a craft brewery to seek investment if retaining majority share and
269 maintaining control of the business. This stance can allow a business to expand and access new
270 markets. Here, we adopt the stance taken by the Brewers Association, and propose retaining a
271 minimum 75% ownership of the business; a value above this would act as an excluding criteria
272 (Brewers Association, 2018b).

273 **3.5 Ingredients**

274 The creation of unique flavours has been a key selling point of craft brewing (Bastian *et al.*, 1999). As
275 previously discussed by Bogdan et al (2017) non-malted grains such as barley, corn, rice, wheat, oats
276 and rye are known as solid or mash vessel adjuncts. The liquid or kettle adjuncts varieties include
277 malt extract popular among home brewers and sugar syrups derived from sugar cane and sugar beet
278 (Bogdan and Kordialik-Bogacka, 2017). A variety of beer styles can help differentiate breweries but
279 also demonstrates an in depth understanding of various styles and brewing techniques required to
280 produce e.g. sour beer or barrel aged beers. The use of high quality raw ingredients is expected to be
281 an essential characteristic of craft beer and is often discussed as central to the ethos of many craft
282 breweries (Kleaban and Nickerson, 2012). This point is often highlighted with breweries detailing the
283 specific ingredients on the packaging and sometimes openly sharing the recipes for their beers. For

284 example BrewDog have published the “DIY Dog” – a collection of all beer recipes from the entire
285 BrewDog range for home brewing replication (Watt and Dickie, 2018). In addition to providing the
286 home brewer with an opportunity to reproduce recipes, this also has an additional advantage of
287 showing complete transparency with the ingredients used. There has been some speculation over
288 the type and quality of raw ingredients used in beer produced by multinational breweries, with
289 barley being substituted with other lower-cost fermentable ingredients such as rice and maize
290 (Poreda *et al.*, 2014). The basis for this is reported to be to produce a beer that is lighter in colour
291 and supposedly flavour (Stika, 2017). However there is also significant suspicion that such
292 substitutions may be more financially motivated rather than driven by quality and flavour objectives
293 (Watt and Dickie, 2013). For example, sucrose based syrups are used to produce a higher gravity
294 wort at lower cost than barley malts, often as the preliminary step to high gravity dilution as
295 discussed in section 3.3 with the aim to increase the capacity of the brewhouse rather than to
296 improve flavour (Bogdan and Kordialik-Bogacka, 2017). In contrast, craft brewers may advertise their
297 ingredients to promote a beer, and this practise is often seen when breweries collaborate to
298 produce a one-off beer (Omnipollo, 2018; Brewdog, 2019). The style of beer and ingredients are
299 often announced on social media platforms as a low-cost but powerful method to promote their
300 product (Figure 2). A recent Instagram post from a Danish brewery named Mikkeller shared what
301 they claim to be the first collaboration with a brewery from Bhutan using an unusual ingredient
302 combination including pineapples and Himalayan pink salt. This can be seen as an example of a
303 modern day brewery responding to the growing demand by the consumer for transparency and the
304 desire to know more about where the food comes from, and that it is produce safely and sustainably
305 (Beulens *et al.*, 2005; Wognum *et al.*, 2011; Mangla *et al.*, 2018).

306 **Figure 2: Mikkeller collaboration with Namgay Artisanal Brewery (Namgay Artisanal Brewery, 2018)**



307

308

309 **3.6 Creativity and innovation**

310 One factor that is not so regularly discussed when defining craft beers is the diversity of choice on
311 offer to consumers. The evolution of big brewing has resulted in mass production of a limited
312 number of brands, potentially leaving the consumer with a few choices of beer. The majority of beer
313 produced by the big organisations is lager with a few ale or stout options. These are heavily
314 marketed to the consumer in television advertisements and online, with some brands going a step
315 further by associating beer with events, sports or pastimes (Vinjamuri, 2019). The BBPA reported
316 that Lager is the most popular beer in the UK making up 74% of the total beer sales in 2016 (BBPA,
317 2016). On the other hand in terms of independent or small scale brewing there is an endless list of
318 beer styles that is on offer to the consumer (Gatrell, Reid and Steiger, 2018). Craft breweries have
319 the agility to make one off, experimental or seasonal beer and later decide if a new beer should be
320 added to a core range based on consumer feedback. This is an important characteristic of many craft
321 breweries. However, it is the choice of the individual brewery as to whether they produce an ever
322 changing range of beer by experimenting with different styles and ingredients or simply focus on a
323 core range and do it well. This is considered to be a reliable metric to establish whether a brewery is

324 craft or not as it is an important indicator that could be readily used to inform consumers about the
325 craft nature of a brewery.

326 The following table includes the characteristics found to be associated with craft beer together with
327 a short description. Some characteristics have previously been identified as essential factors and are
328 thus considered to be exclusion criteria. If a single exclusion criteria is found for a particular beer or
329 brewery where it is brewed, the craft identity is negated.

330 **Table 2 Craft beer characteristics – Full list**

Characteristic	Description
1. Size	A maximum annual production no more than 200,000hl
2. Automation	The overall process governed by human control with automation supporting the human decision
3. High Gravity Dilution	Producing wort with a higher original gravity then diluting the alcohol content.
4. Ownership	The brewery must retain 75% ownership of the business.
5. Ingredients	The use of adjuncts for the purpose of enhancing the overall flavour and experience not substituting ingredients to reduce the cost of production.
6. Creativity and Innovation	A range of core and seasonal beer, a variety of various beer styles e.g. Sour beer or barrel ageing

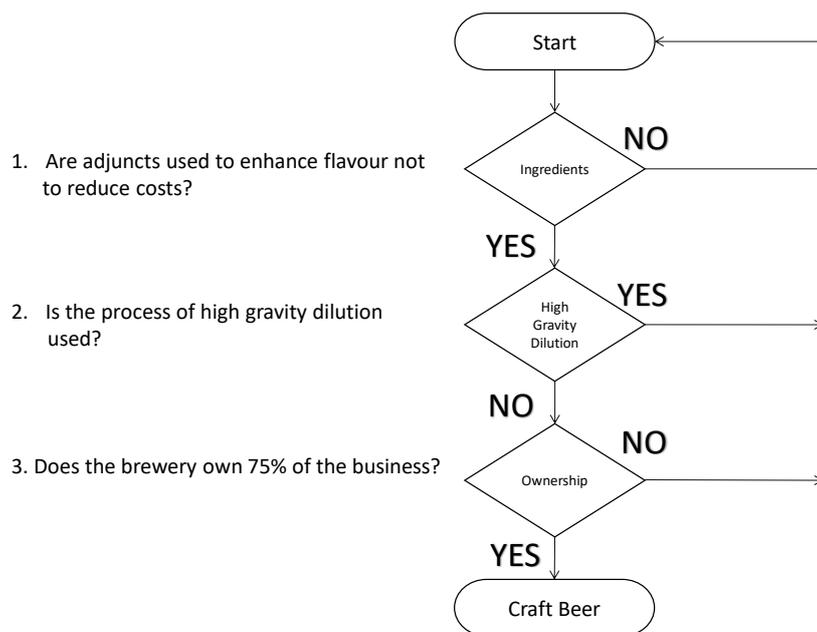
331

332 **4 Discussion**

333 This assessment has taken the approach of reviewing the current literature and viewpoint of
334 prominent brewers within the UK brewing industry that have been outspoken about the topic of
335 craft beer and established industry associations to define craft beers. This exercise has highlighted
336 that the term “craft beer” is far more complex and difficult to accurately define than previously
337 postulated by consumers, industry stakeholders and academics (Gómez-Corona *et al.*, 2017). From
338 this, a conclusion is made on a subset of the relevant criteria that can be used to define craft beers
339 from the full list in Table 3 and these criteria are evaluated below. The proposed shortlisted criteria
340 could be used by industry associations to verify a brewery’s compliance, e.g. in order to qualify for
341 the use of a “craft” seal mark. Proposed criteria could also be employed by the retail industry,
342 particularly supermarkets, to allocate shelf spacing for a “genuine craft beer range” or even to edit

343 out craft “imposters” from their assortment (e.g. to demonstrate commitment to provenance and
 344 sustainability). Some characteristics have previously been identified as essential factors and could be
 345 used in this case as exclusion criteria. If a characteristic from table 3 is appointed as exclusion criteria
 346 it could be viewed the beer and brewery in question fall outside the definition and therefore the
 347 craft identity would be negated. The UK has been reevaluating its relationship with the EU and an
 348 important point to consider is that the UK is the foremost importer of beer from elsewhere within
 349 the EU (Brewers of Europe, 2017). Figure 3 shows a process diagram to assist in the determination of
 350 whether a beer can be categorised as craft or not. This exercise is designed to exclude beer that is
 351 non craft by answering three questions.

352 **Figure 3: Flow diagram to assess craft beer based on pertinent criteria proposed in this study**



353
 354
 355
 356
 357
 358 **Table 3: Conclusions on criteria pertaining to the definition of craft beer**

Characteristic	Description	Appropriateness	Concluding Comments
1. Size	A maximum annual production no more than 200,000hl.	Indicative Criteria	Size criteria should be removed as an excluding criteria and observed as an indicative criteria.
2. Automation	The overall process is governed by human control with automation supporting human decision making by (a) craft person(s).	Indicative Criteria	Impractical. Could be used as a defining criterion but would require brewery inspections, and boundaries of automation and human control fuzzy.
3. High Gravity Dilution	Producing wort with a higher specific gravity than the final beer, and diluting down to produce the final product.	Excluding Criteria	This is a useful exclusion criterion that indicates decision making driven by cost rather than flavour beer
4. Ownership	The brewery must retain 75% ownership of the business.	Excluding Criteria	A useful metric and simple to gather evidence
5. Ingredients	Adjuncts are selected for the purpose of enhancing the overall flavour and experience, not simply to reduce the cost of production.	Excluding Criteria	An important criterion that is central to the craft brewing ethos
6. Creativity and Innovation	The brewery produces a diverse and evolving range of core and seasonal beers, including a variety of beer styles (e.g. sour beer or barrel aged beer).	Indicative Criteria	A useful criterion to indicate craft brewing

359

360 4.1 Production size

361 The annual production of a brewery has been included by industry associations. It is a factor that will
362 undoubtedly provoke disagreement. After reviewing the literature this criterion we propose that
363 there is no evidence to support any specific threshold, and therefore conclude that **this criterion**
364 **should be withdrawn entirely to place emphasis on other important defining criteria.**

365 4.2 Automation

366 The hands on process of brewing is an intrinsic aspect of craft beer that attracts consumers (Rice,
367 2016). As for other artisan products, there is a need to define this desirable quality. Producing beer
368 using a fully automated control system, as one would expect to see at a modern brewery, means
369 that the craft person is somewhat disconnected from the produce he or she creates. It would be
370 foolish for a brewery to decide not to utilise modern instrumentation for the benefit of efficiency, to

371 reduce wastage and maintain quality. A modern facility can still be viewed as craft brewery providing
372 that human decision making is the overall controlling factor throughout the brewing process. As with
373 many small businesses often employing a limited workforce, the use of technology can be essential
374 for the smooth running. One observed example of this had a single person running the business. This
375 brewer was not in a position to employ any workers, but instead used instrumentation to monitor
376 the fermentation process remotely, allowing the business owner to spend more time at home with
377 family and enabling a healthier work life balance. This factor valued as a way of informing the
378 consumer how the beer is produced but this is not considered suitable as a excluding criteria.

379 **4.3 High gravity dilution**

380 This process has potential financial benefits for mass production but this is a polar opposite focuses
381 of craft brewing and this has been discussed as having an effect on qualities such as head retention
382 (Stewart, 2007). Given that members from the craft beer industry have also expressed a negative
383 view of this process we propose this should be used as an exclusion criteria (Watt and Dickie, 2013).
384 It is the breweries decision what information to print on the label and original specific gravity is not
385 always shown. For this to be a possible criteria a certification scheme would need to verify this
386 regulated by a governing body.

387 **4.4 Ownership**

388 It is very important to take in to consideration the ownership when questioning whether a brewery
389 is craft or not. The negative views held by independent breweries have been discussed earlier in
390 regards to accepting investment from multinational brewing organisation and the inflexible attitude
391 towards any collaboration with a recipient of such investment. Whilst investment from a third party
392 being either a larger brewery or investment company can enable a business to grow and potentially
393 access new markets there is also a sense of suspicion by consumers surrounding outright ownership
394 given that the investors ability to influence production and accounting amongst other things, this
395 might have an effect on the quality of the final product (Frake, 2016). It is wise to set an ownership

396 limit for the craft brewery to continue operations as normal but equally important to enable growth
397 through investment there for it would be wise to adopt the stance taken by the Brewers Association
398 with a 25% ceiling on investment.

399 **4.5 Ingredients**

400 The central point that should have no compromise is the quality of the raw ingredients going into a
401 craft beer, because taste, provenance and authenticity are key characteristics attributed to craft
402 beer by consumers (Gómez-Corona, Lelievre-Desmas, *et al.*, 2016). The use of high quality raw
403 ingredients and the use of adjuncts to enhance the overall beer experience and not to reduce costs
404 should be viewed as a core criterion. This point is set to safeguard quality and maintain a distinction
405 from mainstream mass-produced beer. Sugar syrup is an example of an adjunct used primarily to
406 enhance alcohol yield rather than deliver distinct flavour, and as such, when used as a primary
407 adjunct, can be readily identified as an exclusion criteria for craft definition. There may be some
408 ambiguity over other low-cost adjuncts such as maize and rice, but the onus rests on the brewer to
409 demonstrate that such ingredients contribute to a distinctive flavour. Some brewers already share
410 specific information on their websites, but this key information would be more appropriately shared
411 at the point of sale, with packaging appealing to both the proactive retailers and consumers. It is also
412 important to understand the view of brewers who feel that sharing such information could affect
413 their competitive advantage, and to navigate this matter it may be necessary for a certification body
414 to take control of this and to confidentially check compliance on all matters and to provide a system
415 as simple as a tick box to show the successful achievement of all criteria.

416 **4.6 Creativity and innovation**

417 This could be used as a defining criterion and as previously discussed the craft producers have the
418 ability to experiment and make new beers as limited release before incorporating to a core range.
419 This also could be a requirement for meeting the craft definition if it was adopted by an industry
420 association and complying with this could simply require the creation of new beer's annually. This

421 ensures that the skills of the crafts person are continually developed and encouraged to express
422 themselves with new ingredients.

423 **5 Limitations of the study**

424 It must be noted that some criteria do have limitations surrounding the availability of information
425 regarding specific activities has been difficult to obtain from a desk top analysis. The subject of
426 ownership is often publicly reported in newspaper articles and social media platforms when a
427 company is acquired and this has been found to be the simplest criteria to verify. The original
428 specific gravity is sometimes shared, this is quite simple information to include on packaging but
429 without this voluntarily being available high gravity dilution is difficult to clarify. This is another
430 reason for a governing body to take responsibility over a certification scheme. Although it has no
431 overall effect on the definition, it is believed that indicative criteria should be available to the
432 consumers to understand how the beer is made in order to facilitate an informed decision.

433 **6 Conclusion**

434 To ensure quality and maintain credibility it stands to reason that a craft beer can only come from a
435 genuine craft brewery. However, there are no universally accepted definitions of what a craft beer
436 or craft brewery is. In this paper, we critically explore existing definitions and propose a set of
437 universally applicable criteria to rigorously distinguish craft beer. It might be easier to define what
438 craft beer isn't rather than what it is, as it is such a contentious subject. Any attempt to define craft
439 beer such as our will inevitably provoke debate and come under some scrutiny. Craft beer is
440 certainly not mass produced and it is difficult to associate craft beer with multinational brewing and
441 the organisations who produce mainstream beer. Craft beer is perceived as "honest" and
442 uncompromising in terms of flavour, but may be either traditional or modern. Craft beer is made
443 using traditional brewing processes and uses the best quality raw ingredients with adjuncts included
444 to enhance the flavour and experience not to reduce cost.

445 **7 Recommendation**

446 It is recommended that to safeguard the true quality and identity of craft beer, an independent and
447 autonomous industry board or organisation is required to check individual compliance with a set of
448 objective criteria, such as those proposed in this paper. Broad acceptance of criteria for “craft”
449 definition by the sector would require intensive stakeholder consultation by the prospective
450 validating organisation, with a clear mandate to ensure that criteria remain meaningful and
451 verifiable. Whilst greater transparency of ingredients and brewing processes is required, ideally
452 though labelling, this must be balanced with the need to maintain a degree of confidentiality around
453 proprietary processes. An opt-in labelling scheme could be based on voluntary sharing of such
454 information, which in itself may be a useful indication of craft credentials.

455 **References**

- 456 Argent, N. (2018) ‘Heading down to the local? Australian rural development and the evolving
457 spatiality of the craft beer sector’, *Journal of Rural Studies*. doi: 10.1016/j.jrurstud.2017.01.016.
- 458 Bastian, C. T. *et al.* (1999) ‘Niche Market Potential: The Case of the U.S. Craft Brewing Industry’,
459 *Review of Agricultural Economics*. doi: 10.2307/1349898.
- 460 BBPA (2016) *The Statistical Handbook 2016*. Edited by British Beer and Pub Association.
- 461 Beulens, A. J. M. *et al.* (2005) ‘Food safety and transparency in food chains and networks.
462 Relationships and challenges’, *Food Control*. doi: 10.1016/j.foodcont.2003.10.010.
- 463 Bogdan, P. and Kordialik-Bogacka, E. (2017) ‘Alternatives to malt in brewing’, *Trends in Food Science
464 and Technology*. Elsevier Ltd, pp. 1–9. doi: 10.1016/j.tifs.2017.05.001.
- 465 Brewdog (2019) *BrewDog vs Northern Monk - Tokyo Death*. Available at:
466 <https://www.brewdog.com/brewdog-vs-northern-monk-tokyo-death> (Accessed: 12 February 2019).
- 467 BrewDog (2017) *Brand Overview*. Available at: [http://448f59f74df57015bbb8-
468 a9447b7dfa4ae38e337b359963d557c4.r88.cf3.rackcdn.com/BrewDog Equity for Punks V deck.pdf](http://448f59f74df57015bbb8-a9447b7dfa4ae38e337b359963d557c4.r88.cf3.rackcdn.com/BrewDog%20Equity%20for%20Punks%20V%20deck.pdf).
- 469 Brewers Association (2018a) *Craft Beer Industry Market Segments*. Available at:
470 <https://www.brewersassociation.org/statistics/market-segments/> (Accessed: 19 October 2018).
- 471 Brewers Association (2018b) *Craft Brewer Defined*. Available at:
472 <https://www.brewersassociation.org/statistics/craft-brewer-defined/> (Accessed: 19 February 2018).
- 473 Brewers Association (2018c) *Defend Independance*. Available at:
474 [https://www.brewersassociation.org/business-tools/marketing-advertising/independent-craft-
475 brewer-seal/](https://www.brewersassociation.org/business-tools/marketing-advertising/independent-craft-brewer-seal/) (Accessed: 15 November 2018).
- 476 Brewers Association (2018d) *United States Breweries*. Available at:
477 <https://www.brewersassociation.org/directories/breweries/?type=micro&term=United>

- 478 States&searchby=country (Accessed: 19 October 2018).
- 479 Brewers Association (2019) *Brewers Association*. Available at: <https://www.brewersassociation.org/>.
- 480 Brewers of Europe (2017) *Beer Statistics 2017 Edition*. doi: 10.1002/0471684228.egp13486.
- 481 Brewers of Europe (2018) *Beer Statistics 2018*. Available at:
 482 [https://brewersofeurope.org/uploads/mycms-files/documents/publications/2018/EU-beer-](https://brewersofeurope.org/uploads/mycms-files/documents/publications/2018/EU-beer-statistics-2018-web.pdf)
 483 [statistics-2018-web.pdf](https://brewersofeurope.org/uploads/mycms-files/documents/publications/2018/EU-beer-statistics-2018-web.pdf).
- 484 Centinaio, G. M. (2016) *Chapter V PROVISIONS ON THE PRODUCTION OF ARTISAN BEER*. Italy:
 485 unionalimentari. Available at: [http://www.unionalimentari.com/en/ultimora-alimentare/legge-](http://www.unionalimentari.com/en/ultimora-alimentare/legge-2872016-n154-estratto-art35-e-36--birra-artigianale-e-filiera-luppolo.aspx)
 486 [2872016-n154-estratto-art35-e-36--birra-artigianale-e-filiera-luppolo.aspx](http://www.unionalimentari.com/en/ultimora-alimentare/legge-2872016-n154-estratto-art35-e-36--birra-artigianale-e-filiera-luppolo.aspx).
- 487 Chakraborty, K., Roy, I. and De, P. (2015) 'Controlling Process of a Bottling Plant using PLC and
 488 SCADA', *Indonesian Journal of Electrical Engineering and Informatics*, 3(1), pp. 39–44. Available at:
 489 <http://section.iaesonline.com/index.php/IJEEI/article/viewFile/125/pdf>.
- 490 Cooper, D. J., Stewart, G. G. and Bryce, J. H. (1998) 'Some reasons why high gravity brewing has a
 491 negative effect on head retention', *Journal of the Institute of Brewing*. doi: 10.1002/j.2050-
 492 0416.1998.tb00979.x.
- 493 Craft & Slice (2018) *Beavertown Extravaganza 2018 – Brewery List Released*, *Craft & Slice*. Available
 494 at: [https://craftandslice.com/beer/beer-news/beavertown-extravaganza-2018-brewery-list-](https://craftandslice.com/beer/beer-news/beavertown-extravaganza-2018-brewery-list-released/)
 495 [released/](https://craftandslice.com/beer/beer-news/beavertown-extravaganza-2018-brewery-list-released/).
- 496 Dahm, M. and Mathur, A. (1990) 'Automation in the food processing industry: distributed control
 497 systems', *Food Control*, 1(1), pp. 32–35. Available at:
 498 <https://www.sciencedirect.com/science/article/pii/095671359090118V>.
- 499 Daneshkhu, S. (2016) 'Shareholders back AB InBev and SABMiller £79bn "Megabrew" deal', *Financial*
 500 *Times*, 28 September. Available at: [https://www.ft.com/content/925d4c1e-84f7-11e6-a29c-](https://www.ft.com/content/925d4c1e-84f7-11e6-a29c-6e7d9515ad15)
 501 [6e7d9515ad15](https://www.ft.com/content/925d4c1e-84f7-11e6-a29c-6e7d9515ad15).
- 502 Davies, R. (2015) 'Camden Town Brewery sold to world's biggest drinks company', *The Guardian*, 21
 503 December. Available at: [https://www.theguardian.com/business/2015/dec/21/camden-town-](https://www.theguardian.com/business/2015/dec/21/camden-town-brewery-sold-inbev-worlds-biggest-drinks-company)
 504 [brewery-sold-inbev-worlds-biggest-drinks-company](https://www.theguardian.com/business/2015/dec/21/camden-town-brewery-sold-inbev-worlds-biggest-drinks-company).
- 505 Elzinga, K. G., Tremblay, C. H. and Tremblay, V. J. (2015) 'Craft Beer in the United States: History,
 506 Numbers, and Geography', *Journal of Wine Economics*. doi: 10.1017/jwe.2015.22.
- 507 Farrell, S. (2015) 'SAB Miller buys Meantime to enter UK craft beer market', *The Guardian*, 15 May.
 508 Available at: [https://www.theguardian.com/business/2015/may/15/sab-miller-buys-meantime-to-](https://www.theguardian.com/business/2015/may/15/sab-miller-buys-meantime-to-enter-uk-craft-beer-market)
 509 [enter-uk-craft-beer-market](https://www.theguardian.com/business/2015/may/15/sab-miller-buys-meantime-to-enter-uk-craft-beer-market).
- 510 Fastigi, M. *et al.* (2015) 'The irresistible rise of the craft brewing sector in Italy : can we explain it?', in
 511 *4th AIEAA Conference – Innovation, productivity and growth. 11-12 June 2015*.
- 512 Ferguson, E. (2016) *Craft Brew*. 1st edn. Edited by Z. Alkayat. London: Frances Lincoln.
- 513 Fillis, I. (2004) 'The Internationalizing Smaller Craft Firm: Insights from the
 514 Marketing/Entrepreneurship Interface', *International Small Business Journal*. doi:
 515 10.1177/0266242604039481.
- 516 Fletchall, A. M. (2016) 'Place-Making Through Beer-Drinking: A Case Studies of Montana's Craft
 517 Breweries', *Geographical Review*. doi: 10.1111/j.1931-0846.2016.12184.x.
- 518 Frake, J. (2016) 'Selling Out: The Inauthentic Discount in the Craft Beer Industry', *Institute of*

- 519 *Operations Research and the Management Science*, 63(11). Available at:
520 <https://pubsonline.informs.org/doi/abs/10.1287/mnsc.2016.2517>.
- 521 Furnari, C. (2011) 'Goose Island Acquired By Anheuser-Busch', *brewbound*, 28 March. Available at:
522 <https://www.brewbound.com/news/update-goose-island-acquired-by-anheuser-busch-2>.
- 523 Gamble, J. (2001) 'Modelling the Invisible : the pedagogy of craft apprenticeship', *Studies in*
524 *Continuing Education*, 23(2). Available at:
525 [https://www.researchgate.net/profile/Jeanne_Gamble/publication/240524773_Modelling_the_Invisible_The_pedagogy_of_craft_apprenticeship/links/59d64880f7e9b42a6a9f980/Modelling-the-](https://www.researchgate.net/profile/Jeanne_Gamble/publication/240524773_Modelling_the_Invisible_The_pedagogy_of_craft_apprenticeship/links/59d64880f7e9b42a6a9f980/Modelling-the-Invisible-The-pedagogy-of-craft-apprenticeship.pdf)
526 [Invisible-The-pedagogy-of-craft-apprenticeship.pdf](https://www.researchgate.net/profile/Jeanne_Gamble/publication/240524773_Modelling_the_Invisible_The_pedagogy_of_craft_apprenticeship/links/59d64880f7e9b42a6a9f980/Modelling-the-Invisible-The-pedagogy-of-craft-apprenticeship.pdf).
527
- 528 Gatrell, J., Reid, N. and Steiger, T. L. (2018) 'Branding spaces: Place, region, sustainability and the
529 American craft beer industry', *Applied Geography*. doi: 10.1016/j.apgeog.2017.02.012.
- 530 Gillespie, B. and Deutschman, W. A. (2010) 'Brewing Beer in the Laboratory: Grain Amylases and
531 Yeast's Sweet Tooth', *Journal of Chemical Education*. doi: 10.1021/ed100442b.
- 532 Gómez-Corona, C., Lelievre-Desmas, M., *et al.* (2016) 'Craft beer representation amongst men in two
533 different cultures', *Food Quality and Preference*. doi: 10.1016/j.foodqual.2016.05.010.
- 534 Gómez-Corona, C., Escalona-Buendía, H. B., *et al.* (2016) 'Craft vs. industrial: Habits, attitudes and
535 motivations towards beer consumption in Mexico', *Appetite*. doi: 10.1016/j.appet.2015.10.002.
- 536 Gómez-Corona, C. *et al.* (2017) 'The building blocks of drinking experience across men and women: A
537 case study with craft and industrial beers', *Appetite*. doi: 10.1016/j.appet.2017.05.026.
- 538 Hancock, E. (2018) 'Beavertown confirms £40 million stake sale to Heineken', *The Drinks Business*, 21
539 June. Available at: [https://www.thedrinksbusiness.com/2018/06/beavertown-confirms-40-million-](https://www.thedrinksbusiness.com/2018/06/beavertown-confirms-40-million-stake-sale-to-heineken/)
540 [stake-sale-to-heineken/](https://www.thedrinksbusiness.com/2018/06/beavertown-confirms-40-million-stake-sale-to-heineken/).
- 541 Henderson, S. M. and Miller, G. E. (1972) 'Hop drying—Unique problems and some solutions',
542 *Journal of Agricultural Engineering Research*. The British Society for Research in Agricultural
543 Engineering, 17(3), pp. 281–287. doi: 10.1016/S0021-8634(72)80032-5.
- 544 Howard, P. (2017) 'Craftwashing in the U.S. Beer Industry', *Beverages*. doi:
545 10.3390/beverages4010001.
- 546 Kleaban, J. and Nickerson, I. (2012) 'TO BREW, OR NOT TO BREW—THAT IS THE QUESTION: AN
547 ANALYSIS OF COMPETITIVE FORCES IN THE CRAFT BREW INDUSTRY', *JOURNAL OF THE*
548 *INTERNATIONAL ACADEMY FOR CASE STUDIES*, 18(3), p. 59. Available at:
549 <https://www.abacademies.org/articles/jiacsvol18no32012.pdf#page=69>.
- 550 Kok, Y. J. *et al.* (2018) 'Brewing with malted barley or raw barley: what makes the difference in the
551 processes?', *Applied Microbiology and Biotechnology*. doi: 10.1007/s00253-018-9537-9.
- 552 Kovács, B., Carroll, G. R. and Lehman, D. W. (2013) 'Authenticity and Consumer Value Ratings:
553 Empirical Tests from the Restaurant Domain.', *Organisation Science*, 25(2), pp. 458–478. Available
554 at:
555 [https://www.researchgate.net/profile/Balazs_Kovacs8/publication/266077864_Authenticity_and_C](https://www.researchgate.net/profile/Balazs_Kovacs8/publication/266077864_Authenticity_and_Consumer_Value_Ratings_Empirical_Tests_from_the_Restaurant_Domain/links/55fcfa3f08aeafc8ac52f75f.pdf)
556 [onsumer_Value_Ratings_Empirical_Tests_from_the_Restaurant_Domain/links/55fcfa3f08aeafc8ac5](https://www.researchgate.net/profile/Balazs_Kovacs8/publication/266077864_Authenticity_and_Consumer_Value_Ratings_Empirical_Tests_from_the_Restaurant_Domain/links/55fcfa3f08aeafc8ac52f75f.pdf)
557 [2f75f.pdf](https://www.researchgate.net/profile/Balazs_Kovacs8/publication/266077864_Authenticity_and_Consumer_Value_Ratings_Empirical_Tests_from_the_Restaurant_Domain/links/55fcfa3f08aeafc8ac52f75f.pdf).
- 558 Laughman, C. (2017) 'Water, water everywhere, including the bottom line', (November). Available
559 at: [https://search-proquest-](https://search-proquest-com.ezproxy.bangor.ac.uk/docview/2094362621/fulltext/184B806BA1564EDDPQ/1?accountid=14874)
560 [com.ezproxy.bangor.ac.uk/docview/2094362621/fulltext/184B806BA1564EDDPQ/1?accountid=148](https://search-proquest-com.ezproxy.bangor.ac.uk/docview/2094362621/fulltext/184B806BA1564EDDPQ/1?accountid=14874)
561 [74](https://search-proquest-com.ezproxy.bangor.ac.uk/docview/2094362621/fulltext/184B806BA1564EDDPQ/1?accountid=14874).

562 Lima, L. *et al.* (2011) 'Comparing the impact of environmental factors during very high gravity
563 brewing fermentations', *Journal of the Institute of Brewing*. doi: 10.1002/j.2050-
564 0416.2011.tb00480.x.

565 Livelli, G. (2012) 'Improving Productivity & Accuracies While Reducing Downtime', *Power*
566 *Engineering*, 116(7), p. 68. Available at: [https://search-proquest-](https://search-proquest-com.ezproxy.bangor.ac.uk/docview/1038459220?accountid=14874)
567 [com.ezproxy.bangor.ac.uk/docview/1038459220?accountid=14874](https://search-proquest-com.ezproxy.bangor.ac.uk/docview/1038459220?accountid=14874).

568 Mangla, S. K. *et al.* (2018) 'Enablers to implement sustainable initiatives in agri-food supply chains',
569 *International Journal of Production Economics*. doi: 10.1016/j.ijpe.2018.07.012.

570 Mintel (2017) *Beer - UK - December 2017 Defining Craft Beer*.

571 Namgay Artisanal Brewery (2018) *Pinapple Gose With Himalayan Pink Salt*, Facebook. Available at:
572 <https://www.facebook.com/NABparo/photos/a.619581351548110/1030211807151727/?type=3&th>
573 [eater](https://www.facebook.com/NABparo/photos/a.619581351548110/1030211807151727/?type=3&th) (Accessed: 2 December 2018).

574 Nurin, T. (2016) 'It's Final: AB InBev Closes On Deal To Buy SABMiller', *Forbes*, 10 October. Available
575 at: [https://www.forbes.com/sites/taranurin/2016/10/10/its-final-ab-inbev-closes-on-deal-to-buy-](https://www.forbes.com/sites/taranurin/2016/10/10/its-final-ab-inbev-closes-on-deal-to-buy-sabmiller/#46896ff8432c)
576 [sabmiller/#46896ff8432c](https://www.forbes.com/sites/taranurin/2016/10/10/its-final-ab-inbev-closes-on-deal-to-buy-sabmiller/#46896ff8432c).

577 Omnipollo (2018) *Yellow Belly 2017*. Available at: <https://omnipollo.com/products/yellow-belly>
578 (Accessed: 12 February 2018).

579 Poelmans, E. and Taylor, J. E. (2019) 'Belgium's historic beer diversity: Should we raise a pint to
580 institutions?', *Journal of Institutional Economics*. doi: 10.1017/S1744137419000080.

581 Poreda, A. *et al.* (2014) 'Corn grist adjunct - application and influence on the brewing process and
582 beer quality', *Journal of the Institute of Brewing*. doi: 10.1002/jib.115.

583 Rahmani, A. *et al.* (2014) 'Social media analysis and summarization for opinion mining: a business
584 case study', *Social Network Analysis and Mining*. doi: 10.1007/s13278-014-0171-y.

585 Rice, J. (2016) 'Professional Purity: Revolutionary Writing in the Craft Beer Industry', *Journal of*
586 *Business and Technical Communication*. doi: 10.1177/1050651915620234.

587 Sennett, R. (2008) *The craftsman, The Craftsman*.

588 SIBA (2018) *Assured Independant British Craft Brewers*, SIBA. Available at:
589 <http://www.indiecraftbrewers.co.uk/> (Accessed: 22 February 2018).

590 Stewart, G. G. (2007) 'High gravity brewing – the pros and cons', *New Food Magazine*, March.
591 Available at: [https://www.newfoodmagazine.com/article/1550/high-gravity-brewing-the-pros-and-](https://www.newfoodmagazine.com/article/1550/high-gravity-brewing-the-pros-and-cons/)
592 [cons/](https://www.newfoodmagazine.com/article/1550/high-gravity-brewing-the-pros-and-cons/).

593 Stika, J. (2017) 'Brewing with corn', *Brew Your Own*, December. Available at:
594 <https://byo.com/article/brewing-with-corn/> (Accessed: 21 March 2019).

595 The Maltsters Association of Great Britain (2019) *Malt - Unravelling the Mystery*. Available at:
596 <http://www.ukmalt.com/malt-unravelling-mystery> (Accessed: 18 March 2019).

597 Thurnell-Read, T. (2014) 'Craft, tangibility and affect at work in the microbrewery', *Emotion, Space*
598 *and Society*. doi: 10.1016/j.emospa.2014.03.001.

599 Vinjamuri, D. (2019) 'Bud Light's Super Bowl Ad: Corn Syrup, Ethics and Mistaken Identity', *Forbes*, 6
600 February. Available at: [https://www.forbes.com/sites/davidvinjamuri/2019/02/06/bud-lights-super-](https://www.forbes.com/sites/davidvinjamuri/2019/02/06/bud-lights-super-bowl-ad-corn-syrup-ethics-and-mistaken-identity/#757e6ee63a39)
601 [bowl-ad-corn-syrup-ethics-and-mistaken-identity/#757e6ee63a39](https://www.forbes.com/sites/davidvinjamuri/2019/02/06/bud-lights-super-bowl-ad-corn-syrup-ethics-and-mistaken-identity/#757e6ee63a39).

602 Wallace, A. (2019) "'Brewing the Truth": Craft Beer, Class and Place in Contemporary London',

603 *Sociology*. SAGE Publications Ltd, 53(5), pp. 951–966. doi: 10.1177/0038038519833913.

604 Watt, J. and Dickie, M. (2013) *Defining Craft Beer, Brew Dog*. Available at:
605 <https://www.brewdog.com/blog/defining-craft-beer>.

606 Watt, J. and Dickie, M. (2018) *DIY DOG 2018 - The Brew Dog Back Catalogue*. 1st edn. Brew Dog.
607 Available at: <https://www.brewdog.com/diydog>.

608 Wells, P. (2016) 'Economies of Scale Versus Small Is Beautiful', *Organization & Environment*. doi:
609 10.1177/1086026615590882.

610 Wognum, P. M. *et al.* (2011) 'Systems for sustainability and transparency of food supply chains -
611 Current status and challenges', *Advanced Engineering Informatics*. doi: 10.1016/j.aei.2010.06.001.

612 Wu, L. *et al.* (2016) 'Influence of information overload on operator's user experience of human–
613 machine interface in LED manufacturing systems', *Cognition, Technology and Work*. doi:
614 10.1007/s10111-015-0352-0.

615

616

617