

Research Proposal

Different type of wood in whisky industry



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Introduction

In Gaelic whisky is considered as the “water of life” and refers to the water that flows through us. Whisky has been in the industry for the hundred years. It has been reported that Scottish farmers may have discovered how to distill whisky by themselves. There are signs as well that Christians missionary monks brought the art of distilling to the country. As Mr J Marshall Robb explains in his book 'Scotch Whiskey', the earliest references to whiskey are much later, in 1494, when an entry is found in the Scottish Exchequer Rolls which mentions 'eight bolls of malt to Friar John Cor for the purpose of making aquavita'. When King James IV was in Inverness during September 1506, his Treasurer's Accounts had entries for the 15th and 17th of the month respectively: 'For aqua vite to the King. . .' and 'For ane flacat of aqua vite to the King. . .'. It is probable that the aquavita in this case was spirit for drinking. In those days they were drinking spirit unaged taking straight of the stills, just sometimes as well adding flavors like honey or herbs to soften rather harsh and aggressive drink.

But history tells that wooden barrels started using for the whisky maturation by the happy accident. As it's said that they distilled more spirit that they could use straight away, so to store distilled spirit until he will be ready for it, he used oak barrel. After sometime when he finally was ready to use spirit drink, he realizes that spirit become softer and more had more flavors and nicer character than original drink. And from then maturation begins as well as the use of the oak barrels.

In older days it was enough just to fill barrels with the spirit and leave it for the while but now whisky maturation gone far more than that. There are several different parameters that makes difference in whisky maturation: Maturation time, Oak (wood) type, freshens of the casks, casks history, size, whisky finishes and climate. All those factors change whisky flavors and they all are very important but the most import for the maturation in the Oak (wood).

Seeing whiskey's migration from its Celtic heartlands as a modern phenomenon that has never been seen before can be tempting. However, whiskey has been produced around the world at different times and places, with some ventures being more successful than others. Penderyn's spiritual ancestor, The Welsh Whisky Company, illustrates the motives and dangers world whisky has traditionally faced. Frongoch, Bala was the site of the founding of the Welsh Whisky Distillery Co. it had good location for the transport links and as well good water and barley source. Frongoch was the first Distillery in Wales. Never less history tells that Evan Williams was the first who put Welsh name in distillery history. It was family's distillery in Dale but in 1705 he left Wales and moved to America and started distilling in Kentucky. While Frongoch Distillery was first Distillery in Wales it was not a small distillery and distilled 390000 LPA per year. But in 1900 Distillery went in to liquidation and it was sold to the local man, but he did not succeed in distillation and it has been closed off.

After nearly 100 years group of friends got together and opened Distillery in Penderyn. In 2000 there were not many countries distilling and maturing whisky (apart Scotland, Ireland and America). We can say that Penderyn was a pioneer in distilling with not a traditional style of Still. And going not by the Scotch Whisky roles.

Research aim

The aim for this research would be to collect data on the different type of wood that could be use for the whisky maturation. There are many “New World” distilleries that are looking for new flavors and new ideas for their whiskies. And they no longer play by the Stoch roles, where need to be just Oak barrels used for the whisky maturation. For the research will be interesting to look for:

Why it is Oak that need to be and it is mostly used for the whisky maturation?

What other type of wood can be used?

Data analysis of the different type of wood

What type of wood it is used in whisky maturation so far?

What it is flavor profile?

Background

Whisky's flavor can take decades to fully mature, especially in Scotland. And while many of those flavors will come from the production process, such the types of barley used, the fermentation times, and the sizes and forms of the stills, an even more crucial component is undoubtedly the simple barrel it will be aged in.

Every nation has its own rules regarding this, however in Scotland, using oak casks for a minimum of three years of maturation is required if a producer wishes to name the finished product Scotch whiskey. For example, anything must mature in virgin or brand-new oak casks in order to be named Bourbon in the United States. Many people in the whiskey industry and consumers of its goods have claimed over the years that the Scotch Whisky Association's stringent restrictions have stifled innovation in the industry's manufacturing. More exotic woods, like pine or chestnut, cannot be used, not even for amusement. Others contend that this stringent regulation has preserved the great quality of Scotch whisky, ensuring that it is respected around the world.

But how did oak end up playing such a significant role in that process?

Since ancient times, casks have been used to transport alcoholic beverages. It is stated that during their invasions of these areas, the Greeks and Romans both utilized casks held together by hoops to ship and store their wines. It is believed that the Latin word cupa, which means vessel, is where the word cooper, the name of the trade for which a person trains when constructing and repairing barrels, came from.

It is stated that whisky was first placed in casks in the early 1800s when distillers realized the cask had an effect on the spirit's maturation. Due of its ability to be made watertight, oak makes a great vessel. Oak is a great container because expert coopers can make it waterproof, but it is porous, allowing the exchange of spirit and wood tannins, which enhance and build flavor during the maturing period.

Regulations regarding the use of barrels in maturation, however, were first put into place in Scotland during the First World War. At that time, the government, under the stewardship of teetotaler David Lloyd George, passed legislation mandating that spirit must mature in casks for a minimum of two years before it can be named whisky, and then for a minimum of three years starting in 1916. This was put in place to prevent harsh, new-make spirit from getting into the hands of gamblers who would

otherwise have to perform tasks like fight in the war. Less whisky entered the market and ended up in the hands of people looking for a diversion from the events of the moment thanks to the bond system. George, a non-drinker, thought this was particularly significant when he famously said: 'Drink is doing more damage in the war than all of the German submarines put together.'

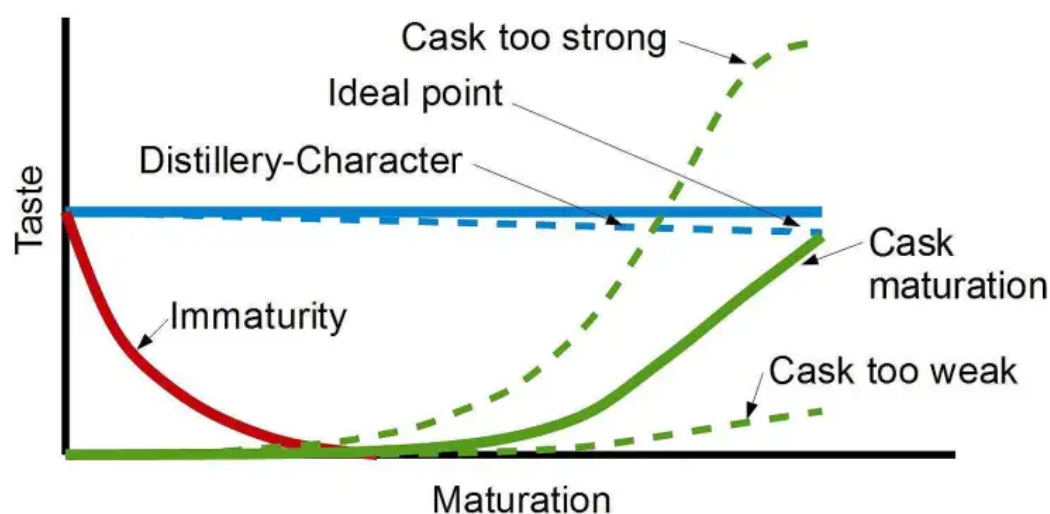
However, new US legislation in the 1930s encouraged Scotch whiskey distillers to use American oak barrels more often. Due to the Coopers' powerful labor union and in an effort to support the lumber industry in the United States after the Great Depression, a law was passed in 1935 that limited the maturation of bourbon to only virgin, brand-new oak casks. This opened the door for a barrel surplus because all the distilleries that had made it through Prohibition could now only utilize barrels once. To recuperate some of their expenses, they started selling the barrels to Scotland, the world's largest whisky producer at the time, whose distilleries eagerly purchased the barrels at a substantial discount.

Whisky maturation in wood is a three-step process that needs to happen in three separate ways. The three processes are additive, subtractive, and interactive, respectively. It is worthwhile to expand on them:

Cask will give the spirit more flavor and personality as an additive. The spirit will be enhanced by the addition of wood sugars, oaky aromas, tannins, the effect of the preceding filling (such as sherry), and color.

subtractive: The cask will take away certain volatiles and compounds from the spirit, softening, mellower, and making it more accessible. Before being used in the beverage business, casks are often burned; the charred wood serves as a natural filter to eliminate unfavorable substances like Sulphur.

Interactivity: This is the creative process. To produce fresh flavors and fragrances, certain chemical and molecular reactions take place between the wood, the spirit, the leftovers from prior fills, and - most significantly - oxygen. The spirits oxidize, the casks breathe, and the oak and spirits change one another. The different oak species may yield varying outcomes in this interacting process. The varied properties of the wood, such as its density, permeability, hemicellulose, lignins, tannins, oils, lipids, and other components, will all have a different effect on the spirit. Despite the fact that the contemporary Scotch whiskey business has existed for more than 250 years, experts and industry members like Dr. Bill Lumsden of Glenmorangie contend that the third interaction process is still only now beginning to be understood scientifically.



The optimal flavor profile of whisky (AUGUST 22, 2017 BY WHISKY WONDER)

Different type of Oak

Although coopers could build barrels and casks from a variety of woods, the American and Scotch whisk(e)y businesses are required by law to utilize oak.

What type of Oak are in use in whisky industry?

The following four stand out: **Quercus Alba, often known as American white oak**, has distinctive vanilla, coconut, and sweet spice scents. The Bourbon industry exclusively uses this kind of cask. When it comes to ageing alcohol, American oak is by far the most productive type of wood. The majority, however, was first used to age bourbon before being sold to outside parties to age everything from tequila to single malt Scotch Whisky, which it most frequently imparts vanilla and fresh fruit tastes to.

The flavor profile of new American oak is subtly different but distinct: sweet, vanilla flavors predominate but are also balanced by spicy and woody notes, and any fruitiness runs the risk of blending with a specific vegetal bitterness.

Quercus Robur or European or Spanish oak.

The term "European oak" typically refers to timber from France or Spain. Sherry casks are frequently used to age alcoholic beverages like Cognac and Armagnac, but whiskey consumers also frequently experience his impact through these barrels.

Although the taste is considerably different, European oak has a grain that is often much more compact than American oak, making it less porous and requiring a bit longer to flavor.

European oak is frequently credited with giving alcoholic beverages a "Darker," "Deeper" flavor profile by leaning away from vanilla and fresh fruit and more toward tannins, stewed citrus notes, a woody, spicy character, and milder dried fruit flavors.

With numerous types of European oak appearing all over the continent, provenance is a deciding factor. Spanish oak, for instance, has a bigger effect on the distillate since it is relatively porous. Colder environment oak kinds, like those from Russia or Ukraine, may have little to no porosity and no effect on flavor. The flavors of tobacco, cedar, nuttiness, coffee, and chocolate are among the popular descriptors of French oak, which mixes an unusual blend of both savory and sweet flavors. Another underrated fact is that more and more whisky is being fully or partially completed in French oak barrels, and this is undoubtedly true in other nations that produce whisky. The wine industry prefers French oak (*quercus petraea*) over American oak because it imparts more subdued flavors to wine. French wood is less thick than American oak (the additive and interactive processes). Having said that, it also gives the wine stronger tannins. When French oak former wine casks are subsequently utilized in the whisky business, the presence of these tannins needs to be carefully checked and kept in check. If the tannins from the French wood combine with any leftover tannin soak from a prior wine filling, it might produce in a "double whammy" of tannins that overwhelm the whisky and upset the balance.

Highland oak

When it comes to the maturing of alcohol, Scotch oak is particularly rare because the tree itself is rare due to years of slow deforestation and nearly usually wild rather than cultivated, making it difficult to work with and build barrels in. Scotch wood is thought to impart a fiery and spicy flavor to the whiskey.

Perhaps European oak offers a more comparable product than American oak.

Ireland oak

Similar to Scottish oak, Irish oak has not been frequently utilized in the manufacture of barrels for the maturing of whiskey, mostly, it would seem, because of the dearth of this wood.

However, recent Middleton Distillery research suggests that this specific type imparts sweet flavors of vanilla, caramel, and chocolate coupled with a fair dosage of woody spices, setting itself out significantly from its Scottish sibling.

Hungarian oak

Particularly uncommon in whiskey maturation, Hungarian oak's effect on the distillate appears to strike an unusual mix between spices, subdued wild berry flavors, and greater depth than the more conventional European oak.

Oak of Japan Mizunara

Mizunara wood is indigenous to the Japanese islands and is frequently mentioned in relation to the unique aroma of Japanese whisky.

Mizunara oak barrels are challenging to build and particularly rare because they are a protected and slowly growing tree type.

In the whisky community, the usage of Mizunara oak, a Japanese-native oak, is frequently the subject of much enthusiasm and discussion. A lot of the time, though, such excitement is really marketing hype. Mizunara is tough to work with commercially: To begin with, the tree must typically be at least 200 years old, and because the wood is so porous, leaks and evaporative stability are perpetual issues. Mizunara barrels of exceptional quality are a particularly pricey product due to their scarcity. The high cost of whiskies matured or finished with Mizunara wood is due to a few factors that most consumers are probably unaware of: According to expert opinion, Japanese and Scotch whiskies need age in Mizunara casks for at least 15 years before the genuine characteristics, flavors, and properties of the wood become apparent. Younger whiskies or those that were only briefly finished in Mizunara oak do not benefit from or have the capacity to exhibit the specific qualities that Mizunara oak can add.

Such barrels have a spicy and mellowing impact on whiskey, imparting notes of St. andalo, incense, coconut, and a dry, tannic edge.

AMBURANA

Amburana, a Brazilian rainforest native, is one of the less well-known woods used to age whisky.

The amburana, which is often used to age cachaça, a Brazilian alcohol made from sugarcane, lends whiskey a potent tonka bean flavor. pronounced vanilla undertones with fragrant coconut and cinnamon overtones.

However, the whiskey market is evolving. The global whiskey boom is still going strong, and distillers are experimenting more than ever. Without any barriers from customs or laws, nations without a whiskey-making tradition have entered the worldwide market. This provides opportunities for some distillers who are looking for uncommon, rare types of oak, of which there are several here.

Here are a few of the wood species that are ushering in a new era of maturation beyond the liquid that a barrel had previously held.

Garry Oak

The Westland distillery in Seattle, which won Washington State Distillery of the Year at the 2017 NY International Spirits Competition, is in charge of the Garry oak-derived Garryana Native Oak collection. Garry oak, a native of the Pacific Northwest, may be found between California and British Columbia. It has notes of roasted coffee, cocoa, and a dark, deep spice.

The problem is that there is no reliable way to obtain the oak because it is so scarce and its usage in whiskey maturation is so new. The Westland team, however, continues to search the West Coast for even a single stave of the oak, despite this. To avoid contributing to the extinction of the species, they take care to use only fallen trees.

25 Garry oak casks were filled in 2016, compared to 10 the year before. In the future, they intend to annually fill 100 casks.

Swedish Oak

By using materials sourced within a 75-mile radius of the distillery, Mackmyra has led the Swedish whisky movement as the first whisky distillery. Mackmyra employs Swedish oak casks that were procured from the south of Sweden, taking the phrase "local" even further. Initially, the oak was employed in ship construction.

According to Angel D'Orazio, the master distiller of Mackmyra, "Swedish oak (*Quercus Robur*) is very slowly cultivated here thus its taste derives from that gradual growth." In comparison to its American siblings, it appears to give a more peppery, spicy side and has less vanilla than *Quercus Alba* from the US.

For a taste of Sweden's native oak, try Mackmyra's Svensk Ek (Swedish Oak) bottling.

Different types of wood are already in use in whisky industry

Apple, Hickory, and Cherry Wood

The Cleveland Underground Select uses a variety of woods in an effort to bring out the many, distinctive flavors that each type of wood can produce.

While the black cherry wood-aged whiskey offers tart, sour notes and sweet spice, the hickory-aged bourbon adds notes of smoke and potent spice. There are expressions of maple, apple, and honey locust wood in the portfolio.

Since 2014, research into whiskey maturation in various wood types has tested knowledge and methodology, but none more so than experiments with **wild cherry casks**, according to Kevin O'Gorman, Master of Maturation at Midleton Distillery. The result is a world-first in Irish whiskey, with a nose of coconut fiber and ginger, a palate of fresh green herbs, black tea, and unmistakable pot still spices, and a long, fresh finish with prickly spice and hazelnut. The rare, porous wood has been a real achievement to create the perfect balance of flavor.

For one to four years, **acacia wood** purchased from France. The solid acacia wood has a tight grain and was initially aged in a combination of former bourbon and sherry casks. This gave the wood a dark mahogany color and slowly imparted rich nutty and chocolatey flavors.

Chestnut

Players in other nations have been aware of it for a time. Producers like Teeling and Midleton have long pushed the boat in Ireland, where the restrictions are less rigorous than in Scotland. When it comes to checking out new things, such as whiskies aged in casks that previously contained ginger beer, pineapple rum, and other wines, Campbell says that Teeling is really one of his go-to whiskies of interest. His favorite is their Sommelier Selection Margaux Cask. While this is going on, Midleton has experimented with whiskies finished in French chestnut wood, the whiskey offers banana, slight cinnamon, and sweet, delicate fruit, and a very small batch finished in **Mulberry wood** for its Method and Madness series.

Yoshino Sugi (Japanese Cedar) Kamiki is a blended whiskey that is aged in Japan and finished in Yoshino Sugi wood, also known as Japanese cedar. It contains both Japanese and imported foreign whiskies.

The Kamiki, the first of its kind, is blended and aged in Osaka, Japan. To make the whisky strong enough to be bottled and subsequently distributed in batches, Japanese spring water is added. Japan's cedar, which is most frequently used for structures and temples, gives the final expression delicate hints of honey, sandalwood, and ginger.

As consumers and distillers alike know that there are a variety of flavors still to be discovered, affected by the countless sorts of wood across the globe, progress is being made in the maturation of distinctive woods. The aforementioned producers' extra effort is paying off even if the casks may be more difficult to assemble and may leak more.

Cotswolds Distillery, founder Daniel Szor still mostly uses oak casks, but he plans to explore with other woods for the brand's experimental collection, including cherry, **acacia**, and chestnut.

D. Szor is quick to emphasize that the focus will always remain on maintaining the DNA of the spirit that pours from the stills in the English countryside, even though he has a little bit more flexibility than his fellow countrymen north of the border. "I think it's important to describe the effect of these 'exotic' casks on whisky as being exactly what it is – flavoring – and as such they can be successful in drawing in new consumers who might be looking for sweeter or more novel flavors."- says Mr. D. Szor.

Research

The intricate chemistry of wood gives it the perfect container for ageing.

Wood chemistry

There are components such as: cellulose, hemicellulose, lignin, and tannins in the wood that creates different flavors in whisky.

A complex carbohydrate made up of sugar molecules is called cellulose. It's either insignificant or has no impact on the spirit, but it's essential for keeping the wood together.

Hemicellulose is made up of several, generally unstable carbohydrates that change when heat is applied, like as when charring a cask. These provide a spirit color and flavors of caramel, toffee, and nuts.

Lignin, which is contained in the tree's cell walls, gives flavors and fragrances like vanilla and smokey and spicy notes.

Tannins, commonly referred to as tannic acid, are phenols that are found in wood, other plants, seeds, tea leaves, and fruit skins naturally. It contributes astringent, bitter flavors and a spirit-like mouthfeel.

Compared to European species of oak, American oak contains larger quantities of the chemical molecule lactone. It emits coconut scents and a woody flavor, like cloves.

To access all of this valuable material, though, the wood must first be opened up. This is where the craft of the cooper comes into play.

So, it is an aim to work closely with the coopers and get as much data as possible to have a better idea what type of wood would be interesting to experiment.

Here in Penderyn we already started experimenting with the different finishes as well as a wood type.

For my Research I will be focusing on Ash wood, Pearwood, Iberian oak, Caucasian Oak, Carpathian Oak.

All over Europe, **ash trees** are grown. Barrels for production uses certified wood that comes from sustainable producers. Light colors, from yellowish to white-reddish, characterize ash wood. Strong, sweet flavor that is reminiscent of honey and minimal tannins make up the unique flavor character.

The **Caucasian Mountains' oaks** provide first-rate wood for barrels with distinctive flavor profiles. Before the production process begins, a lengthy drying procedure assures the greatest quality. Caucasian oak, unlike other types of wood, has soft tannins; mineral, fruity, and fresh flavors make these outstanding barrels shine.

In the foothills of the **Carpathian Mountains**, **oak** trees provide a special kind of barrel-making wood. Local experts meticulously select the wood for the casks. All types of spirits and distillates improve their aromatic profile when ageing in barrels made of Carpathian oak.

Despite the aromas and flavors, they produce, applewood and **pearwood** are relatively infrequently utilized because they lose their seal over time. Pearwood offers a light fruitwood smoke flavor that is round, acidic, and somewhat peppery.

To have fully matured whisky results it take up to 3 years but to have more quicker answers I will be looking in the smaller scale. Working with the coopers we already know what flavors each wood can give. Next step is to work with our New Make Spirit and the wood to see what flavors are developing and to create flavor profile.

As well need to collect more data on the wood itself. How waterproof and pores, how far distilled Spirit can go deep in the wood to extract all the flavors and colors.

Experiment much faster with different maturational variables without getting into the real thing and waiting years to see if an experiment has worked if can miniaturize the maturation process and speed it up (with the enhanced surface area: volume ratio). We can speed up the maturation of whisky, such as miniature barrels, wooden bottles, and these elegant wood-oak sticks.

The main one is that ethanol has a higher potency when whisky is ageing. Oak/wood needs to be toasted and charred in order to be activated. In order to create vanillin and other chemical components that contribute to flavor, this process breaks down the hemicellulose and lignin in the oak. Most experimenters follow this pattern. However, lignin continues to degrade when exposed to

high ethanol concentrations (ethanolysis), creating a range of flavor-activating chemicals. Because 63.5% is the filling strength of the majority of whiskies, using a high strength spirit will enable us to obtain a more accurate result.

The amount of time spent maturing, the ratio of oak/wood surface area to spirit, the environment in which maturation took place, and regulated or simulated oxidation of the barrel are other variables that may affect the correctness of the smell and taste of micro maturation. To emphasize the flavor differences from the original product, should ideally utilize new make spirit or a plain whisky at a high strength.

Is it possible to age whisky using an oak/wood stick plucked from a tree?

Will the flavor and aroma of this "young" oak/wood be different from that of completely mature American Oak, which is typically 80 to 100 years old and cured for a few days to months before use?

Do toasting and charring have different aromas and tastes? Is it possible to miniaturize the maturing process?

I would think that we can say "YES" to all the answers.

Conclusions

A cask wood supply must satisfy the following three requirements:

1. Economic viability—the supply of wood must be sufficient to meet both current and future demand at a reasonable price.
2. Cooperage requirements: the wood must be acceptable in strength and enable for the building of a tight cask with minimal leakage.
3. The wood must possess the qualities required to produce mature whisky with the right flavor. The other two criteria have historically received less attention due to the ability to attain the desired flavor through blending and the possibility that cask treatment may partially impart flavor qualities. The significance of the wood in influencing whisky flavor has been highlighted by improvements in our understanding of the maturation process and the role of the cask in creating flavor congeners.

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